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TRENDS AND FUTURE OF SUSTAINABLE DEVELOPMENT

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INTRODUCTION

Finland Futures Research Centre's 13th international conference *Trends and Future of Sustainable Development* was held in Tampere, Finland in June 9–10, 2011. Sustainable development is a topic that has gained importance in local, regional and global scales and requires multidisciplinary and cross-sectorial cooperation and sharing of ideas and viewpoints. Environmentally, socially, economically and culturally sustainable development can only be achieved by encouraging knowledge sharing and cooperation between various sectors and decision makers.

Finland Futures Research Centre promotes futures oriented research and thinking. Futures studies include tools for describing possible, probable and desirable variations of the present and drafting possible images of the future. By exploring the variety of different possibilities, we can come closer to shaping the future – rather than predicting it. Thus, futures studies can offer valuable tools for the search of sustainable development paths.

The conference brought together 168 participants from 16 different countries. Four keynote speeches representing both academia and private sector were invited:

- Prof. Alan Warde (University of Manchester): “Social Sciences and Sustainable Consumption”
- Executive Vice President of Corporate Relations and Sustainability Anne Brunila (Fortum Corporations): “Tomorrows Sustainable Energy Solutions and Urban Living”
- Prof. Peter Nijkamp (Free University Amsterdam): “Sustainability Challenges to Idyllic Landscapes”
- Prof. Richard Aspinal (Macaulay Land Use Research Institute): “Accounting for Human-Environmental Relationships: Beyond Ecosystem Assessment”

In addition, 32 parallel sessions with the following themes were held. Each theme has its own chapter in this publication.

- Sustainability Indicators
- Sustainability in North-South Perspectives
- Sustainable Consumption
- Sustainability and the Society
- Sustainable Culture
- Sustainable Economy
- Corporate Responsibility
- Futures Methods
- Sustainable Transportation
- Sustainable Energy
- Sustainability in Design

In addition, an expert panel chaired by Prof. Markku Wilenius discussed “Measurement and indicators of sustainable development”. The panelists included Prof. Em. Pentti Malaska (Finland Futures Research Centre), Mr. Oras Tynkkynen (Finnish Parliament), Prof. Sergio Ulgiati (Parthenope University of Naples) and Prof. Mario Giampietro (Autonomous University of Barcelona).

Hanna Lakkala & Jarmo Vehmas

1. SUSTAINABILITY INDICATORS

GROUPING AND RANKING THE EU-27 COUNTRIES BY THEIR SUSTAINABILITY PERFORMANCE MEASURED BY THE EUROSTAT SUSTAINABILITY INDICATORS

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ABSTRACT – *This paper presents the results of a sustainability indicator study on the EU-27 countries where the countries are grouped by hierarchical cluster analysis on the basis of their performance measured with the used sustainability indicators. The used sustainability indicators can themselves be grouped into social, environmental and economic indicator groups, reflecting the different “aspects” of sustainability. In the study, indicators in the three groups have also been calculated into aggregate indicators and the EU-27 countries can be compared and ranked according to their performance measured by these aggregate indicators.*

1. Introduction to the EU-27 case study

This case study was developed within the FP7 project SMILE (Synergies in Multi-scale Inter-Linkages of Eco-social systems, more information available at: <http://www.smile-fp7.eu/>) and was one of the case studies designed to assess the sustainability in the EU context from the economic, environmental and social point of view. Specifically this case study was carried out as part of task 3.7, which requested a study where EU27 countries are grouped in terms of their sustainability performance, assessed by using a set of sustainability indicators. These will be described in detail later on. The grouping of the countries considered is carried out by applying hierarchical cluster analysis to the selected indicators. Sustainability performance is evaluated also through the calculation of aggregate indicators for the different dimensions of sustainability, so that it is possible to rank the countries in terms of their performance.

The aim of this paper is therefore to present both the methodology used and the results of this cluster analysis and of the aggregate indicators created.

2. Material and methods

2.1. The Eurostat sustainability indicator data set

The Eurostat Sustainable Development Indicators (SDIs) are used to monitor the EU sustainable Development Strategy (EU SDS). This set is constituted by more than 100 indicators divided into sub-themes, such as Demographic changes, Climate change and energy, Sustainable transport and Social inclusion (Eurostat, 2011).

Of these 19 indicators were selected according to their relevance for each of the sustainability dimensions considered in this study. They will be described in paragraphs 2.4.1, 2.4.2 and 2.4.3.

2.2. Cluster analysis as a method of grouping EU-27 countries

Cluster analysis is used in many disciplines for different purposes, but with the same aim of creating groups; cluster analysis is an umbrella-term for different algorithms that generate groups of statistical cases whose members are similar to other members of the same group on the basis of a certain criteria. The basic data needed as input for the cluster analysis is thus a matrix X containing the variable values for each of the *objects* under investigation, which in the present work correspond to the EU27 countries, that is

$$X = \begin{pmatrix} x_{11} & x_{12} & \dots & x_{1p} \\ x_{21} & x_{22} & \dots & x_{2p} \\ \vdots & & & \vdots \\ x_{n1} & x_{n2} & \dots & x_{np} \end{pmatrix}$$

The purpose of cluster analysis in this case is thus to group the countries, represented by the n rows of X , according to similarities (or *proximities*) reported in the p columns of X , which in our case are the values for each of the indicators considered.

Different methods are available to proceed with the analysis, but in the case of hierarchical *agglomerative* clustering, which is used in this study, the classification consists of a series of partitions of the data where the first consists of n single-members clusters, while the last is made by a single group containing all n individuals: at each step individuals or groups of individuals which are closest are fused together (Everitt, 1993).

As the indicators included in this analysis were of various natures, the cluster analysis was executed on the normalized distance matrices of the indicators. Thus, before proceeding with the cluster analysis the distance matrix of each indicator had to be calculated and the distances normalized.

However, since the indicators were of different measurement scales (years, percentages, kgoe, etc.), they could be put in the same matrix only after they had been normalized. To compute the distances of each indicator, the city block distance was used. This distance measure represents the distance between points in a city road grid and examines the absolute differences between the coordinates of a pair of

objects, i.e. countries. The city block distance is calculated as: $d_{ij} = \sum_{k=1}^n |x_{ik} - x_{jk}|$. The entries of the obtained distance matrix were then normalized by dividing them by the maximum value of the distance matrix.

2.3. Scoring and ranking

The countries analyzed in this study were scored according to their sustainability performance measured with the selected indicators. For each indicator a weight and a ranking logic were selected. The weight measures the relative importance of the indicator in respect to the other indicators in the same dimension, and it also determines the maximum scoring points available from that indicator, i.e. the points given to the best performing country measured by the indicator. The ranking logic determines if the smallest or greatest value of the indicator is seen as the best performance: normal ranking logic implies a higher score for a greater value, while reversed ranking logic implies a higher score for a smaller value.

For each indicator, the best performing country was given the number of points equal to the weight of the indicator, while the worst performing country was given a score of zero; the other countries received a linearly scaled score according to their relative performance in respect to the best performing country.

The normalized total score indicates the country’s performance measured by the selection of sustainability indicators in comparison to the overall best performing country in the EU-27 group. This analysis does not give a picture of the development of performance over time, only the performance of the EU-27 countries in relation to each other.

2.4. Indicator and relative weight selection

2.4.1. Social dimension indicators

Weight	4	2	4	4	4
Ranking logic	Reversed	Normal	Reversed	Reversed	Reversed
Indicator	Total long-term unemployment rate (%)	Life expectancy at age 65 for males	Suicide death rate (crude death rate per 300 000 persons)	Persons with low educational attainment (%)	Early school-leavers (%)

Total long-term unemployment rate (%): this indicator was selected for its relevance in the context of social sustainability. Unemployment is known to go hand in hand with a number of other social problems. A weight of 4 was chosen as it is the only indicator relative to the working conditions which is present in this analysis.

Life expectancy at 65 for males (years): life expectancy at 65 gives a view to the general health of the population as well as the health care system. Life expectancy for males displays more variance than female (or total) life expectancy and was therefore selected.

Suicide death rate (crude death rate per 300 000 persons): this indicator was chosen as a proxy indicator of the happiness of the population. The suicide death rate of three age classes (15-19 years, 50-54 years and over 85 years) were summed up so to calculate the “total suicide death rate” for each country.

Persons with low educational attainment (%): education was considered as a very relevant aspect of sustainability within the social dimension, thus a weight of 4 was given to this indicator. Data was adequately available only from 2000 onwards.

Early school leavers (%): for the same reason presented above, also this indicator received a weight equal to 4. Data was adequately available only from 2000 onwards.

2.1.2 Environmental dimension indicators

Weight	2,5	4	2,5	2,5	3
Ranking logic	Reversed	Normal	Reversed	Reversed	Reversed
Indicator	Final energy consumption of road transport (TOE/capita)	Renewable energy (% gross electricity consumption)	Municipal waste generated (kg/capita)	Motorization rate (number of cars per 1000 people)	Emissions of particulate matter from road transport (kg per capita)

Weight	1,5	1,5	2,5	1,5
Ranking logic	Reversed	Reversed	Reversed	Normal
Indicator	Emissions of acidifying substances (kg per capita)	Emissions of ozone precursors (kg of ozone-forming potential / capita)	Domestic Material Consumption (tonnes/capita)	Area under organic farming (% of utilized agricultural area)

Final energy consumption of road transport (toe/capita): this indicator was selected to describe the transportation pattern of the countries considered. As there are also two other indicators dealing with road transport, a weight of 2,5 was chosen.

Renewable energy (% in total energy consumption): being the only indicator relative to the use of renewable energy in this set, it was given a weight equal to 4.

Municipal waste (Kg/capita): Municipal waste indicates a strain on the environment that a consuming population cannot easily export to other statistical geographic entities and is for this reason a well suited indicator of sustainability at the local level when compared to, for example, heavy industry emissions. A weight of 2,5 was chosen for this indicator as it is relevant, but gives no indication of the waste treatment typology.

Motorization rate (number of cars/ 1000 people): this indicator was selected because of its relevance in describing the transportation habits of a country. As there are also two other indicators dealing with road transport, a weight of 2,5 was chosen.

Emissions of PM from road transport (kg/capita): This indicator was considered relevant in assessing the pollution deriving from the transportation sector. As there are also two other indicators dealing with road transport, a weight of 3 was chosen. This indicator can be criticized on the grounds that the average population densities of EU27 countries differ greatly.

Emissions of acidifying substances (kg/capita): together with the other two indicators relative to pollution, it assesses the air quality of the countries considered. A problem with industry emissions is that production of consumer goods is global and an economy consuming products of industries producing acidifying substances might not be the same statistical geographic entity. A weight of only 1,5 was chosen, as it is difficult to estimate the emissions deriving from industries established abroad (especially in Asia) by EU countries.

Emissions of ozone precursors (kg/capita): the same description of the previous indicator is valid.

Domestic Material Consumption (tonne/capita): this indicator was chosen because it assesses the amount of material used by an economy. For this indicator data was adequately available only from 2000 onwards.

Area under organic farming (% of utilized agricultural area): this indicator was selected in order to give information concerning the consumers' demand for organic produce. For this indicator data was adequately available only from 2000 onwards.

2.1.3. Economic dimension indicators

Weight	2	3	3	2	3
Ranking logic	Normal	Reversed	Normal	Reversed	Normal
Indicator	Total R&D expenditure (%of GDP)	General government gross debt	GDP per capita in Purchasing Power Standards (PPS) (EU-27 = 100)	Energy dependency	Total employment rate (%)

Total R&D expenditure (% of GDP): this indicator was selected for its relevancy in evaluating the willingness of a government to invest in research and development, as well as the amount of money available for that. However, a weight of only 2 was chosen because the added sustainability largely depends on what type of R&D activities derive from these investments.

General government gross debt (% of GDP): this indicator was selected to give information concerning the financial health of the governments in the EU countries. As it is considered quite relevant to assess the economic prosperity, a weight equal to 3 was given.

GDP per capita (PPS with EU27=100): this is the most direct measure of economic prosperity, thus a weight of 3 was given.

Energy dependency (% of consumption): this indicator was selected to evaluate the self-sufficiency of a country in energy terms. The sustainability level depends on what kind of energy is imported

Total employment rate (%): this is another straightforward measure of the financial health of a country, thus a weight of 3 was selected.

Time series from 1996 to 2006 was selected, but the best data coverage was between 1997 and 2005. In the case of missing values, data was imputed through the use of, average, backcasting or forecasting formulas, depending on the specific case. The threshold of data imputation was set to 15%: if more than this share of data was missing for a specific year, that indicator was excluded from the analysis.

3. Results

3.1. Cluster analysis results



Figure 1. Results for the cluster analysis within each dimension for year 2005

In Figure 1 above are reported the results of the hierarchical agglomerative clustering carried out on the EU-27 countries for the three dimensions of sustainability for the year 2005. Each color denotes a different cluster.

The clusters described here were obtained by choosing the point of the dendrogram with the longest distance between two consequent iterations. The dendrogram was derived using the statistical analysis program SPSS, by running the hierarchical clustering process on the distance matrixes described previously.

In the Social Dimension the clusters formed are the following:

Cluster 1: Estonia, Latvia, Hungary, Lithuania

Cluster 2: Poland, Slovakia

Cluster 3: Czech Republic, Slovenia, Bulgaria, Romania

Cluster 4: Denmark, Finland, Sweden, Austria, France, Germany

Cluster 5: Ireland, United Kingdom, Luxembourg, Netherlands, Belgium, Greece, Cyprus

Cluster 6: Malta, Portugal

Cluster 7: Italy, Spain

As can be understood from the clusters above, there is a clear distinction between the developing economies and countries such as Germany, UK and France which fall in two separate - but close - clusters. Another cluster is made of the Mediterranean countries: Malta, Portugal, Cyprus and Greece, with Italy and Spain very close as well.

In the case of the Environmental Dimension, the clusters obtained are the following:

Cluster 1: Estonia, Greece, Czech Republic, Portugal, Slovenia, Spain, Belgium, Italy, Sweden

Cluster 2: Hungary, Lithuania, France, United Kingdom, Germany, Netherlands, Malta

Cluster 3: Poland, Slovakia, Romania, Bulgaria, Latvia

Cluster 4: Cyprus, Ireland

Cluster 5: Denmark, Finland, Austria

Outlier: Luxembourg

In this dimension the clusters appear more varied than in the social dimension. The distinction between developing economies and richer countries is not that clear anymore in the clusters. This is especially evident in Cluster 1 and 2, which group countries very different among themselves. Luxembourg is completely separated from all the other countries and remains an outlier until the last iteration.

For the Economic Dimension the clusters are the following:

Cluster 1: Latvia, Lithuania, Estonia, Bulgaria, Romania, Poland, Hungary, Slovakia

Cluster 2: Cyprus, Portugal, Greece, Italy, Malta

Cluster 3: Czech Republic, Slovenia, Ireland, Spain

Cluster 4: Austria, Germany, France, Belgium

Cluster 5: Netherlands, United Kingdom, Finland, Sweden

Outliers: Denmark, Luxembourg

In the case of the Economic Dimension, it appears that the developing economies end up mostly in Cluster 1, Mediterranean countries in Cluster 2 and the bigger economies in Cluster 4 and Cluster 5. Luxembourg is again an outlier, together with Denmark.

It is important to note that each dimension presents a different set of groups, so there is no evident cohesion in the grouping of the countries for the three thematic areas. This underlines how important it is to keep this distinction when analyzing sustainability at the national level, as it cannot be assumed that the behavior in one dimension will be replicated in the other two as well.

3.2. Ranking results

In this chapter the ranking results are presented for each dimension and for the years 1997 and 2005.

3.2.1. Social dimension

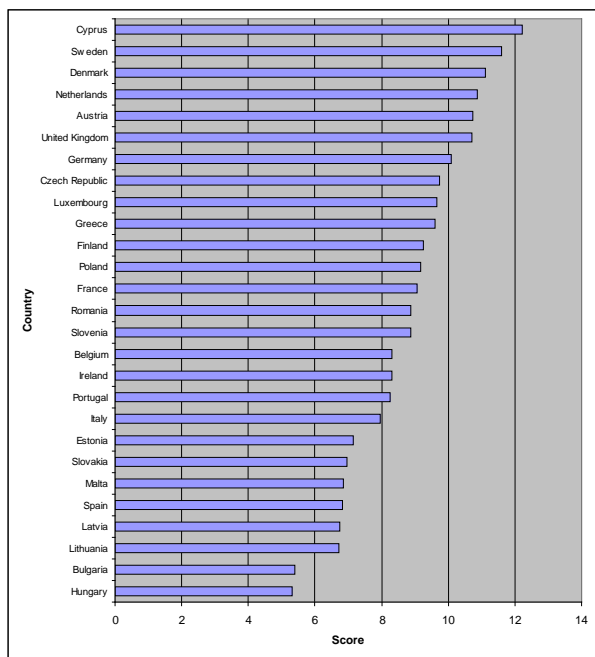


Figure 2.a. Ranking results for the social dimension in 1997

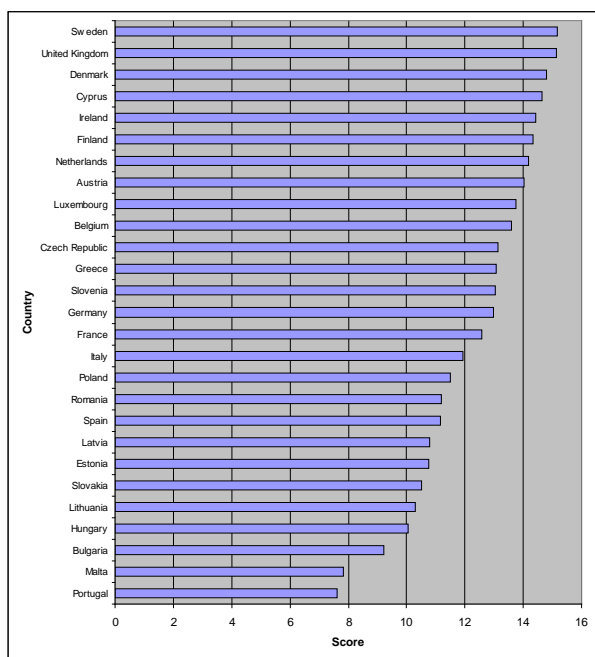


Figure 2.b. Ranking results for the social dimension in 2005

Figure 2.a shows the ranking and the scores for the social dimension in 1997. Cyprus is the best performing country in the EU27 group. It performs well when measured by the selected social dimension indicators by having very low unemployment, low suicide rate and high life expectancy at 65. When measured by the education related indicators Cyprus does not perform as well. Data for early school leavers was sufficiently available only from 2000 onward, so it is missing from 1997 year ranking.

The northwestern European cluster is also performing well in the social dimension, having moderate to high scores in suicide, unemployment and life expectancy indicators and high scores in education indicators. The eastern European cluster appears to be performing very well when measured by the educational indicators, but poorly with the other indicators.

As shown in Figure 2.b, the ranking by social indicators for the year 2005 is mostly the same. The difference in scores between eastern European cluster and the northwestern cluster have become smaller. Portugal's relative performance has worsened greatly.

3.2.2. Environmental dimension

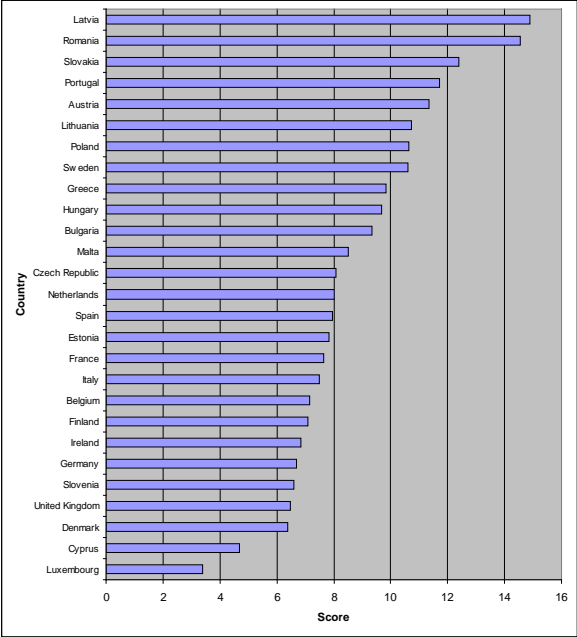


Figure 3.a. Ranking results for the environmental dimension in 1997

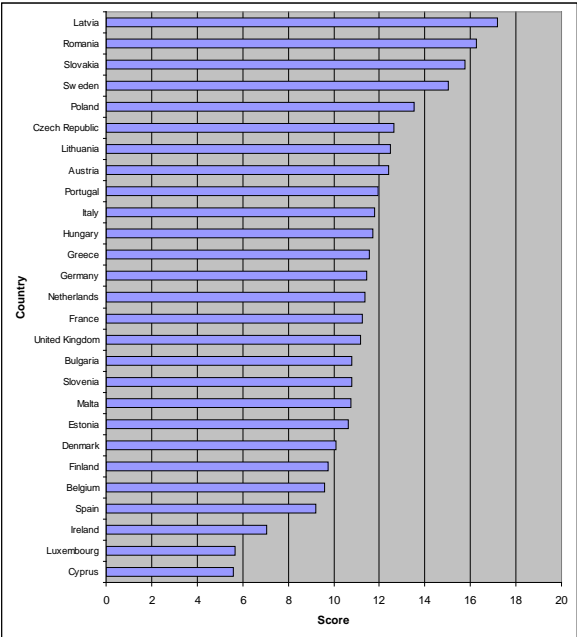


Figure 3.b. Ranking results for the environmental dimension in 2005

As can be seen in Figure 3.a, countries in the eastern European cluster perform very well in the environmental dimension with the selected set of indicators by having low energy consumption of road transport and generating little municipal waste and emissions, and also by having a relatively low motorization rate. From the northwestern European cluster Sweden is performing best, by having average emissions and municipal waste generation and a high score in renewable energy use, as other countries with large hydroelectric reserves do. Indicators that would consider emissions and waste in relation to the wealth generated in the economy could give very different results and ranking.

Figure 3.b shows the total score of the environmental dimension for year 2005. The eastern European countries are still scoring high on many indicators, but the upward trend in the standard of living has made the difference between western and Eastern Europe in environmental dimension scores grow smaller.

3.2.3. Economic dimension

Figure 4.a shows the economic dimension total score for the year 1997. For most indicators the northwestern European countries perform best. Eastern european countries have little government debt and receive high scores when measured with that indicator. Southern Europe performs quite poorly with all indicators.

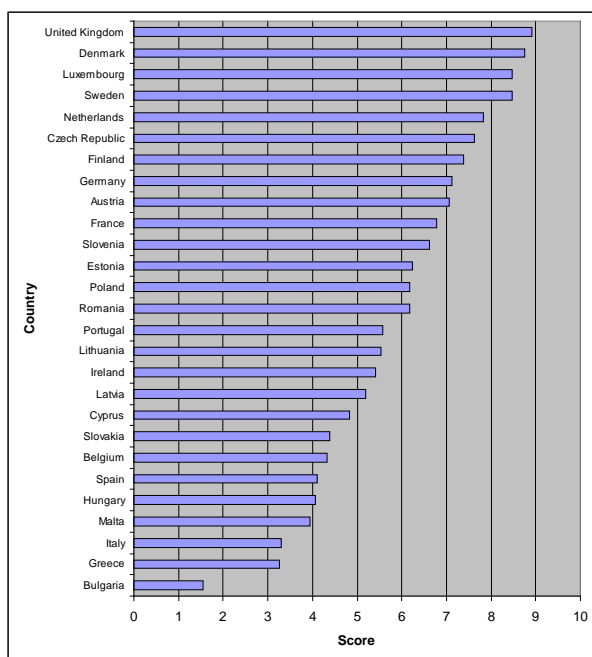


Figure 4.a. Ranking results for the economic dimension in 1997

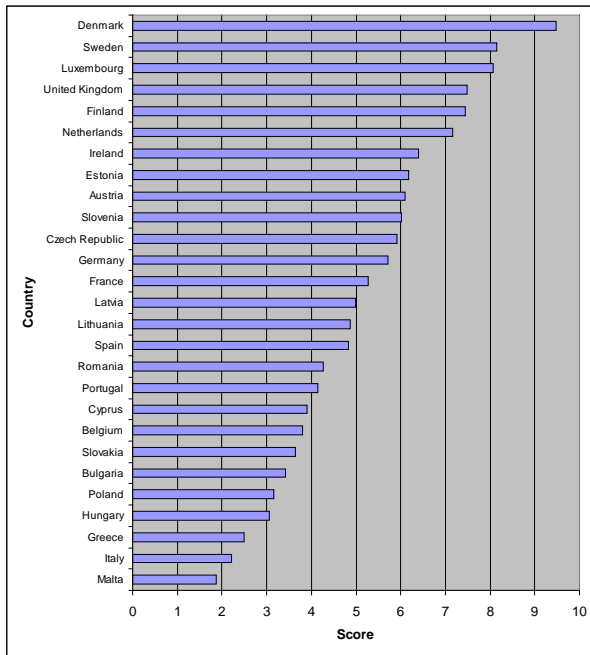


Figure 4.b. Ranking results for the economic dimension in 2005

Figure 4.b shows the total score for economic dimension for the year 2005. It can be noted that differences between EU27-countries' relative performance have become much greater and Denmark's superior performance is even more pronounced than in 1997.

4. Discussion and Conclusions

As can be seen from what was presented here, this analysis should be considered solely as an example of what can be done to study sustainability in EU27 countries with the data currently available. Lack of data has been the major problem in this study and the final set used implied a relevant amount of data imputation. For the same reason certain indicators which would have given an interesting contribute to the analysis, had to be left out (i.e. gender pay gap). This issue therefore limits the wideness of the indicators set and should be one of the main points to be taken into account when evaluating the final results.

The final results, especially the ranking, depend also on the choices made in the selection of the related weights, which are in the end arbitrary. In order to see the effects of a different selection, the tool created for this purpose can be used and new results can be obtained rather quickly. Results of different assumptions should be then compared to evaluate their consistency.

Further developments of this study could include a deeper sensitivity analysis, for example through the use of different cluster analysis and ranking techniques, and the comparison of the obtained results. If forecasted data was available, it would also be possible to carry out the same analysis for future years, thus contributing to the creation of possible scenarios and future planning.

The comprehensive set of results and data used is available on an excel file available on the SMILE website (<http://www.smile-fp7.eu/>).

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“WALKING IN OTHER’S SHOES” – EXPERIENCES OF USING THE DECOIN TOOLS TO CHARACTERISE SUSTAINABILITY TRADE-OFFS IN SCOTLAND AND THE CAIRNGORMS NATIONAL PARK

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ABSTRACT – *The paper presents the experiences of using two of the DECOIN tools, SUMMA (Sustainability Multi-criteria Multi-scale Assessment) and MuSIASEM (Multi-Scale Integrated Analysis Societal Ecosystem Metabolism), to characterise sustainability trade-offs in Scotland and the Cairngorms National Park (CNP). The paper reflects on the theoretical basis of the two tools that provide for complex eco-social systems a coherent conceptual and methodological framework within which to understand better sustainability trade-offs. Translating theory into practice, particularly using tools and methods developed by others, however, remains a challenge. The paper reports the progress of the analysis of changes in the sustainability of the agriculture sector (1991 to 2007 using SUMMA) and for the wider economy (2005-2009 using MuSIASEM) for Scotland and the CNP. Approaches to the communication of SUMMA and MuSIASEM outputs for stakeholder audiences are also presented. The paper concludes that the DECOIN tools have significant utility in conducting theoretically coherent, practical for implementation and policy relevant assessments of sustainability trade-offs but that “walking in others shoes” is not always comfortable.*

1. Introduction

The Synergies in Multi-Level Inter-Linkages in Eco-social Systems (SMILE)¹ project seeks to further develop and apply the DECOIN² tool kit. This toolkit consists of three models: SUMMA (Sustainability Multi-criteria Multi-scale Assessment); MuSIASEM (Multi-Scale Integrated Analysis Societal Ecosystem Metabolism) and ASA (Advanced Sustainability Analysis). The ambition of the SMILE project is to combine these tools into a system of sustainability accounting that provides useful insights into the dynamics of the sustainability of complex coupled eco-social systems (Giampietro et al. 2009).

¹ <http://www.smile-fp7.eu/>

² <http://www.decoin.eu>

The authors applied both the SUMMA and MuSIASEM tools in a case study focused on the Cairngorms National Park (CNP). The objectives of the research were to test the utility for end-users and transferability of the DECOIN tools beyond their development teams and applications. This is reported in Blackstock et al. (in this proceeding). The case-study also tried to assess the role of economic growth in achieving sustainability objectives and the trade-offs between sustainability objectives. This paper reports progress made towards these objectives and highlights the strengths and weaknesses of the DECOIN tools.

The SUMMA and MuSIASEM tools take complementary but distinct approaches to the characterisation of the sustainability of eco-social systems. SUMMA is a life-cycle oriented assessment of the economic-environmental performance of a system. SUMMA uses multiple metrics to characterise system performance. SUMMA considers both the upstream draw on resources and the downstream consequences of waste. MuSIASEM is a conceptual approach to assessing overall performance and performance of components of a system. MuSIASEM incorporates human activity, value added, energy use and land, without resorting to a weightings based normalisation to a single unit of measure. Combined together as defined by the MuSIASEM “grammar” these dimensions provide a coherent and systemic characterisation using indicators of stocks and flows of resources.

A key feature of SUMMA and MuSIASEM is the multi-scale nature of the analysis. This allows the explicit comparison of overall performance and of components, be they sectors or geographically defined regions. This can be highly informative as the “averages” of higher level performance may be made up of very distinctive elements, such that policy or other interventions based on the averages may be entirely inappropriate. In both SUMMA and MuSIASEM the extent and intensity of resource use is simultaneously considered. This is essential to ensure that improvements in efficiency are not eliminated by a rebound in consumption (Jevon’s paradox).

2. Materials and Methods

2.1. Case-studies

The Cairngorms National Park was created as a result of the National Park (Scotland) Act in 2003. It is home to approximately 16,000 human residents as well as significant protected habitats and species. National Parks in Scotland are explicitly required to achieve ‘sustainable development’. Therefore, they are not ‘wilderness reserves’ but fit the IUCN category V (protected landscape). With partners at Parthenope University it was decided that the SUMMA based analysis would focus on the production-oriented land-based industries (PoLbI) (agriculture, forestry and sporting estates). The importance of the sector has been variously argued from minimal (gross value added), to marginal (employment), to important (downstream environmental impacts) and finally as crucial (landscape/character of the region). The focus on PoLbI played to the strengths of the authors and built on a tested SUMMA model for the agricultural sector in Campania (Ulgiati et al. 2008). For the MuSIASEM analysis the case study undertook analyses at Scotland wide level, local authority level and for the CNP as a whole. The analyses considered societal averages, the paid work and industry based sub-sectors. The MuSIASEM case-study followed existing published approaches (Giampietro 2004;Giampietro and Mayumi 2000).

2.2. Methods

Figure illustrates the key stages in the case study analysis. For more in-depth description of the materials and methods see the relevant SMILE deliverables¹. The key challenges in undertaking the analyses were familiarisation with the DECOIN methods (WP2), agreeing a scope with the CNPA through the systems diagramming activity (WP2) and sourcing and integrating the required datasets (WP3). SUMMA is demanding in terms of its data requirements (>250 input values for each of the three time periods). While with MuSIASEM it is possible to progressively step into the degree of detailed required, there were many challenges of incompatible sectoral classifications and units of spatial collection. Several of these could be overcome by accessing more detailed datasets, but energy throughput datasets were limiting both in terms of spatial resolution and length of time series available, (only from 2005). For land use there are multiple sources but their integration (beyond the agricultural sector) is limited. Indeed it was not possible to complete the within-CNP land use analysis within the scope of SMILE.

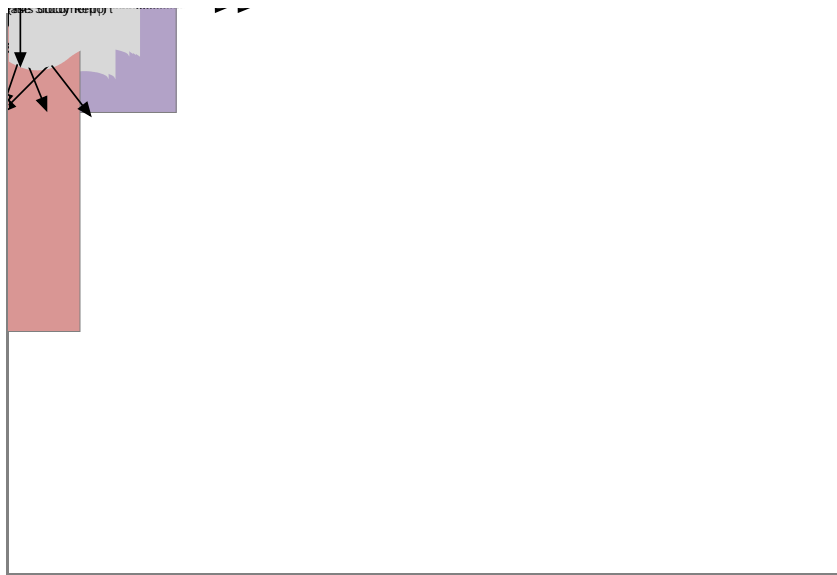


Figure 1. *Scotland case study activities and deliverables.*

3. Results

Within this paper it is only possible to present examples of the key types of outputs used in communications with stakeholders at CNPA, not to summarise all the outputs generated².

¹ www.macaulay.ac.uk/SMILE

² See www.macaulay.ac.uk/SMILE for more comprehensive examples.

3.1. SUMMA examples

Emissions are a key issue for land use in Scotland. The extent of emissions tonnages for Scot_{AG} and CNP_{AG} relative to the baseline year (1991) is presented in Figure. Note that to assess the GHG potential for each of the tonnages presented they need to be converted to tonnes of CO₂ equivalent. In terms of CO₂ it can be seen that for both the CNP and Scotland there is an increase in the emissions from 1991 to 2001 followed by a decrease to below 1991 values by 2007. This reflects a process of intensification based on the structure of agricultural subsidies that was reversed after 2003. For methane and nitrous oxide the pattern is of a reduction from 1991 but with less reduction after 2001.

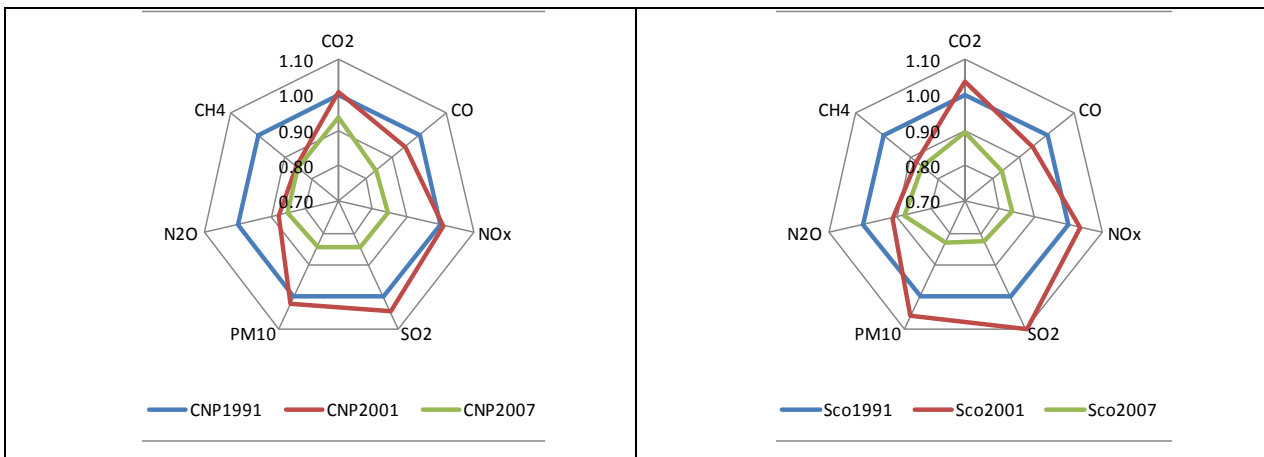


Figure 2. Total Emissions from Scot_{AG} and CNP_{AG} 1991-2007

The relative pattern of emissions for CNP_{AG} and Scot_{AG} have strong similarities in terms of the overall shape of the spider plots. Scotland has a stronger increase by 2001 in CO₂, NO_x, SO₂ and PM₁₀'s associated with more mechanised sectors of agriculture, but also a greater reduction (by 2007), perhaps reflecting a greater reduction in intensity in more remote rural areas pulling down the overall Scotland totals.

Comparing CNP_{AG} and Scot_{AG} also provides useful information about the different nature of their production systems. Figure presents the relative emissions intensities for CNP_{AG} and Scot_{AG} for each of the indicators for 2007 (earlier patterns are consistent but with minor variations). The emissions per ha shows the CNP_{AG} as a very low intensity system (less so in terms of CO₂ but still low) compared with an overall Scot_{AG} average. In terms of emissions per kg of dry matter and per Mj of embodied energy the CNP_{AG} system can be seen to be relatively inefficient since it requires up to six times emissions to generate a comparable output. This reflects the marginal nature of the bio-physical resource available to land managers within the park (in terms of production). This lack of efficiency, is though, offset by the higher value per unit of production so that emission per € are three rather than six times the Scot_{AG} average.

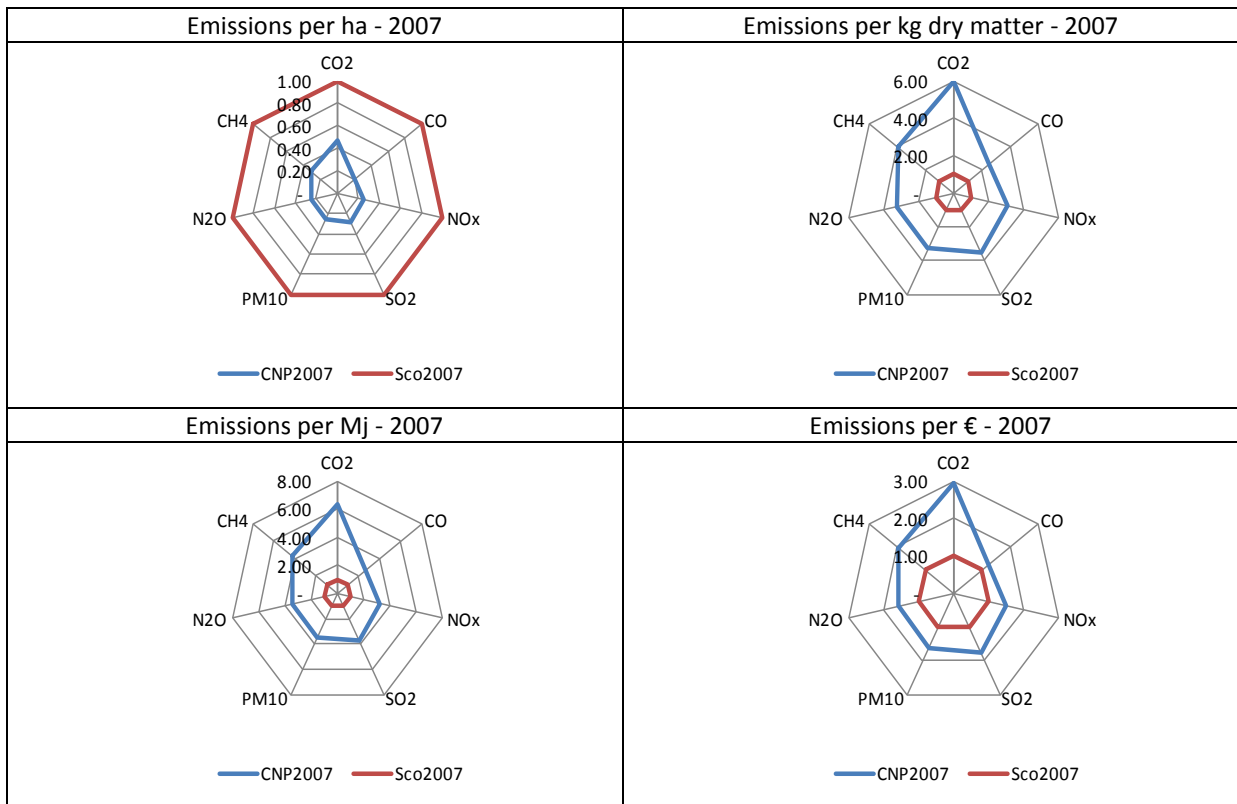


Figure 3. Emissions intensities for CNP_{AG} relative to $Scot_{AG}$ in 2007

3.2. MuSIASEM examples

The combination of Exosomatic Metabolic Rate (mj/hr of activity, EMR) and Economic Labour Productivity (£/hr of activity, ELP) is a particularly useful compound indicator of the sustainability trajectory. This combined analysis reveals complex systems behaviour in terms of trajectories and groups of the regions that can be considered together. Two versions are presented: the societal average and paid work.

Figure presents the societal average EMR/ELP trajectories. Overall there is a pattern of increasing ELP_{SA} with (in nearly all cases) no increase in EMR_{SA} . There is a distinctive pattern to the trajectories, with increases in ELP_{SA} between 2005 and 2007 followed by stagnation (or even decline). For EMR_{SA} the pattern is of either consistent reduction or fairly constant values (2005 to 2007) followed by reductions (2007 to 2009). For regions with lower values for ELP_{SA} the increases in ELP are smaller and in some cases the reductions in EMR are significant (e.g. Clackmannanshire and Fife perhaps reflecting further deindustrialisation). Contrast this with the main population centres (Edinburgh, Glasgow and Aberdeen with its hinterland) where there is significant increase in ELP_{SA} combined with reductions in EMR_{SA} . An overall interpretation from Figure could be that at a societal average level there is a trend to more sustainable growth (albeit to a limited extent). Societal average indicators, however, contain both paid work and household sectors that are behaving quite differently.

For the paid work sector the analysis of EMR/ELP has distinct features. It is clear that for some regions the improved performance for EMR at societal average level is an improvement in the household

sector not in the paid work sector as the EMR_{PW} value is near constant (e.g. Edinburgh and Glasgow). Note that for both these cities despite near static EMR values there has continued to be apparent growth in ELP_{PW} . also shows the value of combining EMR_{PW} and ELP_{PW} in terms of distinguishing distinctive clusters of regions with common sustainability characteristics. These clusters include the main cities as noted above, the Scottish Islands (Orkney, Shetland and Western Isles), city regions (Aberdeen and Dundee but also the Greater Glasgow area) and regions that retain industry or intensive agriculture (East and Mid Lothian, Clackmannanshire and Fife, Perth, Kinross and Stirling and Dumfries and Galloway).

The MuSIASEM fund-flow (FF) diagram is a means of simultaneously presenting the relationship between a fund (e.g. human activity) and a flow (e.g. energy throughput) and at two scales (e.g. societal average and paid work, or paid work and sectors of the economy). The FF diagram is helpful in presenting both the extent (on the axes) and the intensity (on the diagonals) of resource use. Figure compares the CNP and Scotland for each sector using THA, GVA and ELP. Within each FF figure it is possible to assess the relative importance of each sector (by size) and the relative efficiency as defined by the ELP. Comparing FF diagrams the balance of sectors within both regions is apparent. Note that all the FF diagrams are scaled in both THA and GVA relative to the largest sectors present. This allows structural comparisons. Note that the shape of the quadrants provides a visual representation of the balance between THA and GVA. Where the proportions are equivalent the quadrant is a square (e.g. construction), where longer in the x-axis the sector generates more GVA than its proportion of THA would predict (e.g. Business, Services and Finance), where longer in the y-axis the sector generates less GVA than the THA would predict (e.g. Public Administration and Services and Retail, Recreation and Transport).

4. Discussion and Conclusions

The SUMMA analysis found that there have been significant changes in the extent and intensity of agricultural production and its environmental impacts. Our conclusion is that for the agricultural sector as a whole there are unavoidable trade-offs between production and environmental impacts and little or no evidence of synergies, win-wins, dematerialisation or sustainable growth. There is a pattern of increasing resource use and impact from 1991 to 2001 and a subsequent reduction back to 1991 levels by 2007. This fits well with agricultural policy over the period 1991 to 2007. The high water mark of intensification was pre the 2003 CAP reforms with subsequent reduction in production on the least intensive areas. There is little to suggest fundamental changes in the relationships between resource inputs, the outputs from the system and the environmental load.

The MuSIASEM analysis has shown that there is a complex relationship between economic growth and the other indicators of sustainability. This complexity is in terms of the distribution (spatial, sectoral and between social groups) but also in terms of the nature of the growth. In some cases growth simply means increasing extent with more people supported at the same standard of living. In other cases there are changes in the intensity (productivity of labour and energy). From within this complexity it has been possible to begin to identify groupings of regions, their trajectories in terms of growth and the other indicators and to use these to better understand the overall Scotland level assessment and to contextualise the CNP.

The MuSIASEM results for the CNP are significantly different from the *a priori* expectations of the research team. That the CNP has features in common with the cities of Scotland was unexpected. The importance within the area of tourism and recreation means that the CNP has a significant retail and recreation sector. The attractiveness of the area (physical environment) also means that there is a larger than expected business sector with businesses located in the CNP but providing services beyond the park boundary. That the CNP has a more city-like population distribution, retaining young adults, could indicate a successful and sustainable rural economy. It could also mean that the CNP supports a minimum-wage based service economy based on migrant labour. The CNP GVA figure are noted by the CNPA as being inflated by the distilling industry with the income “leaking” from the Park.

From the MuSIASEM analysis there is little or no evidence of ongoing dematerialisation, that is a break in the fundamental relationship between energy use and wealth (or at least GVA) generation. Lower values of EMR simply reflect a post-industrial sectoral mix that has the net effect of exporting the energy and environmental footprint elsewhere. Given Scotland’s commitment to an 80% cut in greenhouse gas emissions by 2050 it is difficult to see how this can be achieved with the current population and/or standard of living, without fundamentally rethinking and reorganising patterns of production and expectations of consumption.

4.1. Strengths and weaknesses of the tools

SUMMA looks both upstream at the effect of inputs drawn into the system and downstream to the outputs and wastes. It is thus possible to make explicit judgements on the costs and benefits of a system. Energy analysis, particularly the intensity ratios, is effective in providing a high level summary of the nature of resource use. Time series of SUMMA outputs identify trends and the impacts of key drivers. Comparison between systems or scales provides an external referent against which to objectively judge system performance. Where there is an existing SUMMA application the process of use is simpler than for MuSIASEM. If, however, modifications need to be made, these cannot be easily undertaken by non-experts. This implies a dependence on the SUMMA developers that can be difficult for them to service. Consideration should be given to investing in the development of a more modular and reusable SUMMA tool that is suited to supporting the development of new applications by third parties.

MuSIASEM provides a systematic evaluation of sustainability, linking evaluations of economic growth to population, energy and land use. The use of a decomposition approach is effective in ensuring that “average” values are fully understood as being the outcomes of mixes at regional or sectoral level. The approach is also effective in demonstrating the dependencies between productive and consumptive sectors. The strongly empirical nature of the MuSIASEM analysis means it is grounded in reality as perceived by stakeholders. This is effective in making it accessible to stakeholders but MuSIASEM’s more challenging conceptual basis can be a barrier to credibility. There were significant challenges in sourcing adequate data to support some of the MuSIASEM analysis despite experience and expertise in data integration and manipulation. This can lead to undesirable compromise the indicators used (data shaping the modelling).

Both SUMMA and MuSIASEM are strongest in analysing the links between environment and economics. They make these analyses in a scientifically coherent fashion, rather than through the use of *ad hoc* indicators. Where they perform less well is in including the social and cultural dimension of

sustainability. While non-use and existence values have been debated within the SMILE consortium there still remains a significant intellectual challenge in defining analyses that are salient, credible and legitimate. Indeed it may be that such social aspects are inherently unsuitable for computer-based modelling and quantification and need to use mixed methods (incorporating qualitative analysis and participatory research processes).

4.2. Implications for mainstreaming the use of SUMMA and MuSIASEM

Both SUMMA and MuSIASEM face an implementation gap in terms of being used for policy-making or management. There are challenges in how to communicate the outputs of the research in a form that is succinct and accessible but does not lose rigour or oversimplify. Issues raised by stakeholders include making transparent the assumptions within the input data, demonstrating how the calculations of the indicators are made and the unfamiliarity of concepts such as emergy. These challenges are doubly difficult when they question established orthodoxy, both in what is important in policy terms (growth) and how it is measured and interpreted. There are significant and powerful vested interests that would be undermined by a more holistic view of sustainability and a more nuanced view of the benefits and detriments of growth. Mainstreaming will require the undertaking of transdisciplinary research, including both academics and stakeholders, with the stakeholders having a more formal role in shaping of research. Such projects ensure the salience of the research and build credibility for the methods and data through processes of stakeholder peer-review. The authors conclude that SUMMA and MuSIASEM have significant utility in conducting theoretically coherent, practical for implementation and policy relevant assessments of sustainability trade-offs but that “walking in others shoes” is not always comfortable.

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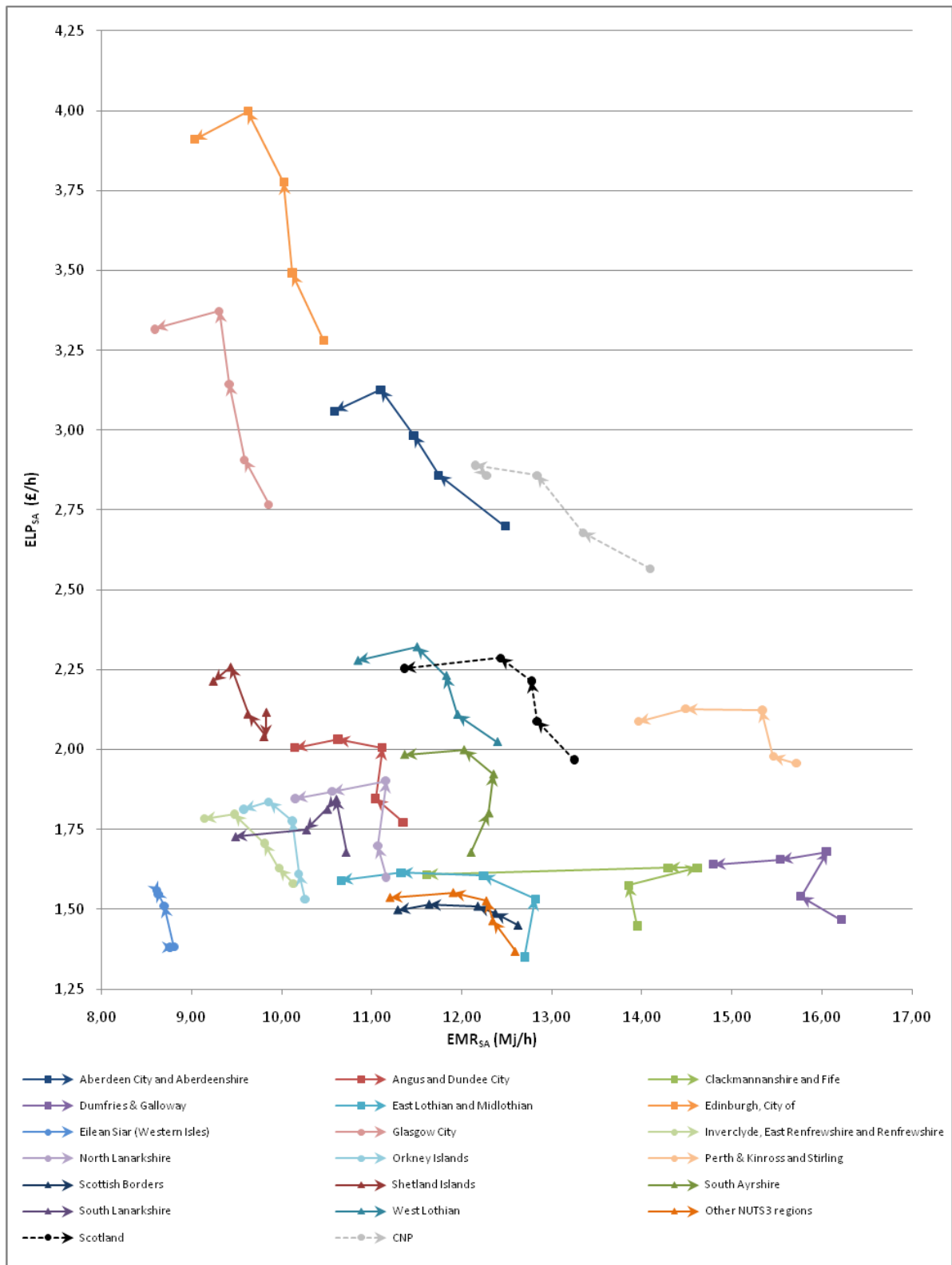


Figure 4. *ELP_{SA} vs. EMR_{SA} for Scotland, CNP & NUTS3 (omitting Falkirk)*

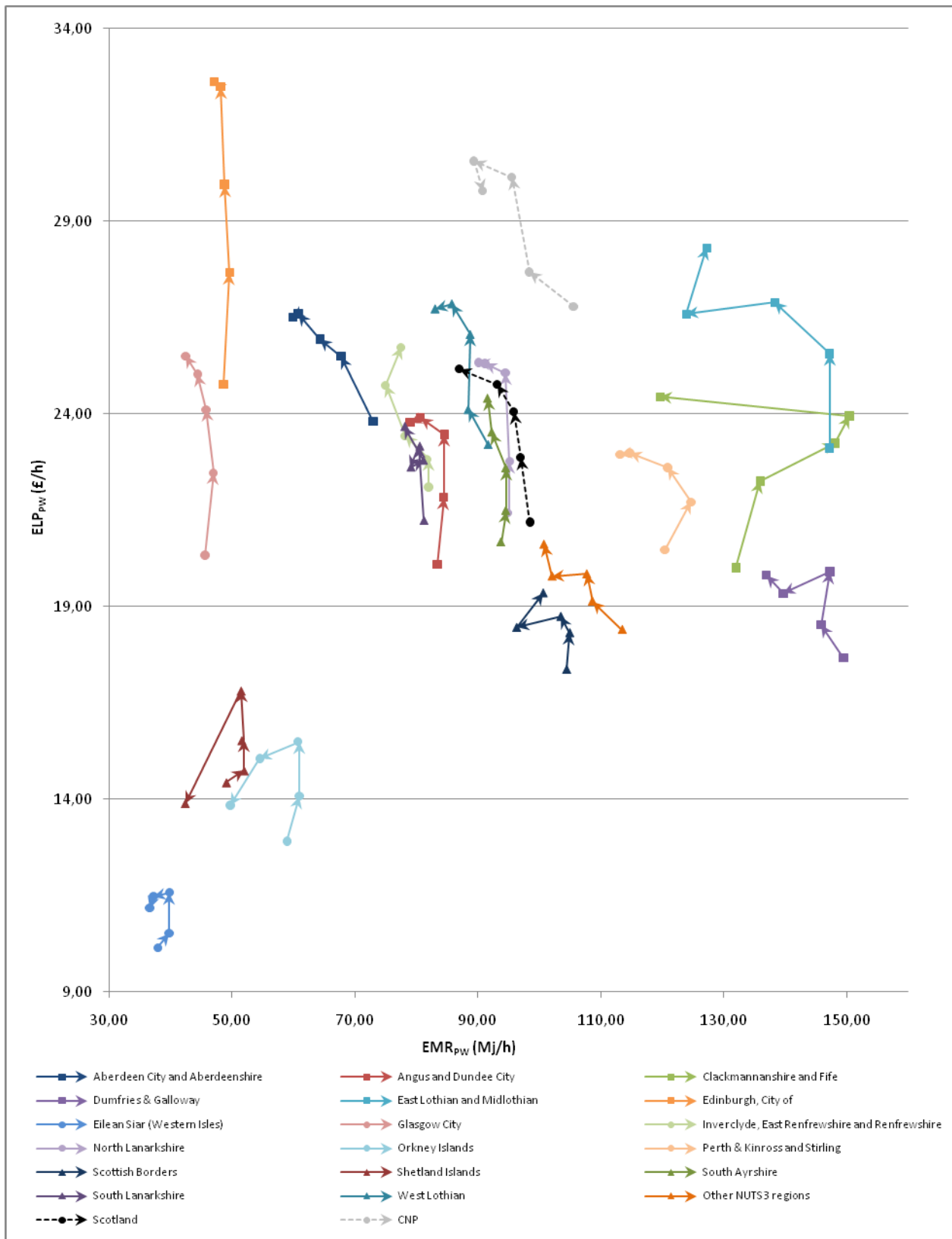


Figure 5. Fund-Flow analysis of Scotland and CNP by sector using GVA and THA

SUSTAINABILITY CRITERIA AND INDICATORS – A TOOL FOR STRATEGIC URBAN PLANNING

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***ABSTRACT** – Urban planners work in the midst of many requirements and expectations, compounded in the need to promote sustainable environment. The process of planning is often hectic, while the planner lacks tools to assess sustainability of different planning options. To enable this assessment sustainability criteria and indicators were developed in an inter-disciplinary research project. Sustainability criteria comprise ecological, social, and economic criteria. The three sets of criteria together include 85 indicators. The criteria were designed for strategic decision making, impact assessment, and monitoring in medium sized urban regions in Finland. The indicators have been tested in two urban regions, Lahti and Oulu.*

1. Introduction and Background

Urban planning entails complex compromising between different expectations and challenges. These include the laws and strategies, which guide and control the planning, the objectives set at different jurisdictional levels, the requirements of different stakeholders and special challenges related e.g. to urban sprawl, ageing population, and climate change. The need for sustainable communities and sustainable development in general has been an important issue in academic forums and environmental policies for long.

According to the Finnish national strategy on sustainable development (Finnish National Commission on Sustainable Development, 2006) sustainable communities mean balanced regional structure, dynamic development rising from individual strengths, functionally diverse and structurally coherent communities and good living environment, availability of public services, functional transport system and prevention of social exclusion. Strategies and plans of actions have been made to enhance sustainable development in numerous municipalities, companies and associations.

A special challenge, however, is to connect sustainable development to regional level planning and find regional level solutions for the promotion of sustainability. Planning problems demanding regional

examination concern e.g. dispersal of urban structure, growing amount of transport, car dependence, fragmentation of green areas, and competition for tax payers between municipalities. To enable this assessment sustainability criteria and indicators were developed in an inter-disciplinary research project called "Sustainable urban land use and transport" (Seutukeke), running from 2008 to 2011. In this project all three pillars of sustainability – ecological, social, and economic – were examined in functional urban regions, each containing various municipalities. Sustainability in urban regions implies that growth and development will not endanger even in a long run biodiversity and ecosystem services (ecological dimension), well-being of people and social justice (social dimension), and economic progress (economic dimension).

The criteria were designed to be used for setting of objectives, impact assessment, and monitoring of land use and transport planning in medium sized urban regions of about 80 000 - 200 000 inhabitants in Finland. In addition, the indicators can also be used in strategic level planning and decision making. Another target of the project was to enhance the use of data and analysis methods in planning. A lot of different datasets, registers and systems with readily usable analysis methods exist in public state and municipal sources, but little is used because of ignorance, lack of skills, or lack of time. In this project criteria and indicators were developed according to the best available scientific knowledge connected to easily available data and methods to enable planning departments in urban regions to carry out the analyses and calculate the indicators by themselves. Because of the regional perspective spatial GIS data was used as much as possible to overcome the problem of administrative borders. Examined phenomena are seldom restricted to administrative borders but form different kind of functional areas. In addition, functional areas are of different shape and size for different phenomena. In order to compare different urban regions to each other, the urban region in the Seutukeke project was formed using a uniform method, according to which it consists of a functional urban region (densely populated areas belonging to one commuting area) (Ristimäki et al., 2003) and surrounding 10 and 15 km distance zones. These buffer zones were selected on the basis of the distance from which urban dwellers in Finland mainly consume cultural ecosystem services in a form of outdoor recreation (Pouta and Heikkilä, 1998).

2. Material and Methods

The work for developing sustainability criteria and indicators for urban regions was started with putting up an interdisciplinary research team of several research institutes. Leader of the project is the Finnish Environment Institute which mainly contributed to the ecological criteria and indicators together with the University of Helsinki/Department of Environmental Sciences, Sito Group, and VTT Technical Research Centre of Finland. Economic criteria and indicators were developed by Government Institute for Economic Research and social criteria and indicators by Sito Group and National Institute for Health and Welfare.

Planning for the criteria was initiated in big workshops where all researchers co-operated to find a common understanding on the targets and working methods of the project and after that to adjust the different dimensions of sustainability together to form a concise and unified set of criteria and indicators. The research group consulted also other researchers and experts when needed to find the best scientific knowledge for the research. The consulted experts include e.g. landscape planners, ground and surface water researchers, transport experts, and GIS experts. The project outline and later a draft

set of criteria and indicators were presented to stakeholders in seminars. The feedback received in these was taken into account in further work.

At the beginning of the actual research work the most important criteria for each dimension of sustainability were formulated. The criteria are expressed as statements describing a desirable state of affairs. The more general main criteria were further split into sub-criteria expressing more detailed statements. Finally, exact indicators describing the criteria and sub-criteria were developed. The development work was based on literature reviews to find out what kind of sustainability indicators have already been recommended for different levels of administration and what is seen important in scientific literature. The most promising indicators were collected or new ones developed and their suitability for urban regions was examined. Suitable ones were thereafter further studied on the basis of available data. Even very descriptive and good indicators had to be rejected if no data was available or if the data was very difficult to obtain. During the course of the research work about 200 suitable indicators were collected but about half of them were later rejected or set aside for the time being because of the previously mentioned reasons. As a result a set of 15 main criteria, 44 second order criteria, and 85 indicators was formed. Because the different dimensions of sustainability are often linked there appeared to be a need to include same kind of indicators in two or even in all three sets – economic, social, and ecological. The preliminary set of criteria was screened so as to remove duplicate indicators, whereas indicators representing more than one dimension of sustainability were marked. About half of the indicators appeared to represent more than one dimension, e.g. describe both social and economic sustainability. Indicators were also marked according to representing climate change or urban structure related issues.

3. Results

Ecological sustainability

Ecological sustainability has been described and defined in many different ways nationally and internationally (e.g. Ministry of the Environment, 1999, Secretariat of the Convention on Biological Diversity, 2000, Euroopan unionin neuvosto, 2006, Commission of the European communities, 2009, Finnish National Commission on Sustainable Development, 2006) but all definitions of the concept emphasize the capability of ecosystems of (a) maintaining central functions and processes and (b) conserving biological diversity in all its forms to present and future generations. The concept is often connected also to sustainable use of natural resources and diminishing the carbon footprint of humankind. The Seutukeke perspective on ecological sustainability is strongly linked to land use of urban regions. Such growth and development of an urban region, which does not endanger biological diversity and ecosystem services even in the long run, can be regarded as sustainable. Sustainability is addressed at the scale of an ecologically functional urban region, which is not limited inside the boundaries of densely populated urban areas, but consists of a continuum of different areas and functions at wider urban region.

Discussion on dispersing community structure and consolidation as its counterforce, and climate change mitigation and adaptation, are topical perspectives related to ecologically sustainable land-use.

These interlinked themes strongly affect land-use planning and at the same time land-use decisions have an impact on climate change, although it is more widely also linked to other areas in the society.

In the Seutukeke project, different dimensions of ecological sustainability related to land-use are being concretized with the ecosystem service approach. Ecosystem services (benefits humans get from nature) have become a significant topic of discussion and application beside traditional nature conservation (Millenium Ecosystem Assessment, 2005, Hiedanpää et al., 2010b, Kniivilä et al., 2011), because such a fresh approach is for instance in Finland seen better in enabling a discussion between nature conservation and use and management of natural resources (Hiedanpää et al., 2010a). Ecosystem services are usually classified in provisioning, regulating, supporting, and cultural services. In the Seutukeke project, regulating and supporting services are emphasized, because they represent the central mechanisms and processes for ecosystems to function (Kolström, 2010). An example of such regulating services is storm water absorption (and via it flood peaks moderation), which is enabled by vegetation, pervious surface, and soil (Niemelä et al., 2010).

Moreover, cultural ecosystem services, especially recreational services providing possibilities for outdoor recreation and nature experiences, are significant in urban regions. Cultural services are produced by natural environments with varying modification levels, built urban parks and rural areas surrounding cities (Niemelä et al., 2010).

Livelihood in cities is not often directly dependent on ecosystem services as in rural agricultural and forestry areas, but they significantly affect the living of urban inhabitants and the function of a city as a physical body of biotic and abiotic environmental factors. Land-use changes in urban regions can deteriorate ecosystem services by worsening their quality or endangering their very existence in certain areas. This may have an impact on how urban nature can resist or mitigate adverse phenomena, such as heat waves, floods and pollution (Colding, 2011). Thus it is essential to preserve enough different kinds of nature areas in urban regions and cities in order to maintain ecosystem services. In today's urban planning and research related to it, the concept Green Infrastructure has been considered as one way to preserve green areas and ecosystem services.

Although most of the Seutukeke ecological criteria and indicators describe ecosystem services directly or indirectly, some also refer to other aspects of ecological sustainability. A number of indicators represent urban structure which is connected e.g. to the use of natural resources and energy for building, infrastructure, and transport, emissions of air pollutants and carbon dioxide and, by implication, impact on climate change, and loss of peri-urban productive land. Also the load caused by human activities in urban region to e.g. surface and groundwater is examined through parameters indicating the quality of water and risk assessment of groundwater areas.

Ecological criteria and indicators

1. Land use: Land use of the urban region supports maintenance of biodiversity and safeguarding of ecosystem services

- Community structure is consolidated (proportion of dwellings built outside local master plan areas, proportion of apartments, jobs and large shopping units located in different urban zones, proportion of inhabitants living in densely and sparsely built areas, proportion of families with two or no cars, commuting travels and commuted distances per

day, proportion of people living in peri-urban villages of all inhabitants living in sparsely populated area)

- Important nature areas are safeguarded (proportion of protected areas of all green areas)
- There are noiseless and silent areas in the urban region (proportion of noiseless and silent areas of the whole land area)
- There are carbon sinks in the urban region (total area and proportion of forests and mires in the urban region)
- Culturally valuable areas are preserved (culturally valuable sites identified on all plan levels)

2. *Green infrastructure: The urban region hosts large and ecologically functional contiguous nature areas and ecological connections*

- There are large and contiguous forest areas in the urban region (proportion of large and contiguous forest areas of total land area)
- There are core nature areas in the urban region (proportion of core nature areas of all forest areas)
- There are functional ecological connections in the urban region (proportion of core nature areas having several ecological connections with other core nature areas)
- There is as little fragmentation as possible (proportion of forest edge zones of the whole forest area and proportion of forest areas larger than 5 hectares of all green and forested areas inside the densely populated area)

3. *Recreation: All inhabitants have a possibility for recreation in nature*

- Recreational green areas are preserved (proportion of areas suitable for recreation)
- Recreational green areas are close-to-home (proportion of inhabitants living max. 300 m distance from area suitable for recreation)
- Shores are accessible for recreation (proportion of free shore line)
- Recreation does not threaten conservation of biodiversity (proportion of inhabitants to areas suitable for recreation)

4. *Water: Functional water cycle enables use of water and good living environment*

- Surface waters produce ecosystem services (water visibility, amount of chlorophyll a, and microbiological quality)
- Clean ground waters are not threatened (proportion of groundwater areas under risk)
- Land use supports water cycle and carbon sequestration (proportion of impervious land area in ground water areas)

5. *Transport: Transport system does not endanger biodiversity*

- Traffic amounts do not threaten biodiversity (traffic amounts in proportion to inhabitants)
- Traffic network does not prevent animal movements or cause fragmentation (road density, area of roads in proportion to inhabitants)

Social sustainability

Social sustainability is an integral part of sustainable development. According to Kautto and Metso (Kautto and Metso, 2008) sustainability considers over generational effects and coherence of politics. There is no universal definition of social sustainability. Several definitions of social sustainability include justice and equality, possibility to affect one's life, and strengthening communal identity.

The national sustainability strategy of Finland determines social sustainability goals (Ministry of the Environment, 2009). These include 1) cohesion between different generations, 2) functionally diverse and structurally sound communities, 3) a good living environment promoting healthy lifestyles, functional capacity, and preventing health threats, 4) preventing social exclusion and poverty, 5) quality of working life, 6) ensuring the availability of services, 7) citizen's satisfaction of service quality, and 8) promoting civil activity.

Finland's National Land Use Guidelines also require the safeguarding of peoples' well-being and the promotion of social justice (Ministry of the Environment, 2002). Often, the social sustainability in urban planning is taken into account by providing participation in planning. This does not, however, systematically take into account all required social sustainability that can be done with social criteria and indicators (Juslén, 1995 cited in STAKES, 2006). There is a need to recognize the effects of transportation and land-use plans on different groups on a regional and local scale.

The Seutukeke social criteria and indicators have been drafted by taking into account the top-down approach of the EU and national context of social sustainability as well as bottom-up approach of individual needs. An important factor has been to consider the basic needs of individuals as defined by Maslow (Maslow, 1973) and Allardt (Allardt, 1973). The provision of basic needs better necessitates the fulfilment of higher level needs. Culture, which is often seen as the fourth element of sustainability, is taken into account in the Seutukeke definition of social sustainability. The spatial scope of criteria chosen is based on the everyday actions of individuals within the region. Land-use and transport affect the everyday life and possibilities of individuals, which in turn affect how individuals can fulfil their needs.

The emphasis of social equality and justice sets some guidelines on forming the criteria. Firstly, it requires considering average indicators that measure the general well-being of the public as well as the differences between different genders, generations, residences, or socioeconomic groups. Secondly, the goals of social sustainability have to be constantly reconfigured. Indicators do not have a certain fixed threshold and must be adjusted to local conditions and aims. Indicators vary subjectively through time between individuals and different demographic and sociocultural groups. Thirdly, social indicators vary spatially significantly. I.e. the same level of services cannot be guaranteed equally throughout the region to all individuals. Services conglomerate naturally which leads to emphasising the accessibility of services to different groups.

It is challenging to determine social indicators at a regional scale. Most social sustainability measures are drafted at a national scale through strategies and policies. Local planning (including master plans and local plans) has a greater effect on social sustainability than regional plans. Land use policy has mostly indirect effect on social sustainability through the changes in land-use. A significant part of social sustainability, along with land-use planning, is affected through the policies of other municipal institutions, such as health services.

The chosen indicators aim to consider differences between different demographic and socioeconomic groups, take into consideration national strategy and individual needs, as well as work through space and time. Also other criteria and indicators were considered but discarded due to lack of data. Social impacts constitute parts of a larger entity and should not be studied detached from other environmental impacts (Välimäki and Kauppinen, 2000). When dealing with social data, individual privacy must be considered. Because of this some of the indicators were generalized to a municipality scale although they could also be calculated to a grid of adequate square size to generalize individual data.

Social criteria and indicators

1. The region has a diverse and vibrant social community

- Age structure is balanced (age groups by municipality)
- Socioeconomic structure is balanced (long-time low income, linguistic division)
- Culture and sports facilities are accessible (built culture and sports facilities, culture and sports facilities in public transport zones)
- Citizens are active (voting turnout, civic organisations)

2. The region has diverse employment and education opportunities

- Diverse and sufficient provision of employment (unemployment by municipality, income groups by municipality)
- Workplaces are accessible (commuting distance)
- Diverse and sufficient provision of education (proportion of vocational graduates, enrolments, enrolments by sector)

3. The environment is healthy and safe

- Harmful effects of land-use are allocated fairly (facilities causing disturbance)
- The environment does not harm health (citizens affected by noise pollution, air-quality, transport emissions)
- The environment is safe (injuries caused by traffic accidents, violent and property crimes)

4. The region has a diverse residential supply

- Sufficient occupancy rate (occupancy rate, overcrowding)
- Residential supply is sufficient and diverse (residential zoning types, home ownership types)

5. Basic services are accessible for all

- Daily local services are accessible (daily local services)

6. Easily accessible public and pedestrian transport services are provided

- Service quality of public transport encourages use (bus stops, train stops)

Economic sustainability

The existence of cities is based on concentration and agglomeration advantages. This means that the proximity of various producers and consumers creates common advantages in comparison to a dispersed settlement pattern. The advantages can be born at the input side, in the form of shared cost of common facilities (e.g. harbour), as well as at the output side in the form of scale effects in markets (more nearby clients, and less search cost for clients). For business it is also advantageous to have sufficient choice in labour supply (diversity, no scarcity) and vice versa for workers it is advantageous to have more choice in jobs and careers. In turn a large employment base means also a concentration of purchasing power, which attracts an expanding scope of consumer oriented services (retail, education, entertainment, etc.). With all these factors present a more dynamic set of agglomeration advantages emerges, which can lead to further accumulation of population and economic activity. As a consequence at least in some parts of the urban area the productivity per acre gets so high that it also significantly pushes up land prices and hence real estate prices. Consequently, a process of selective expulsion (from economic core areas) starts up. In turn this implies that, in absence of further measures, the city starts to expand over an ever larger area and to show more spatial segregation in functions. Both expansion and segregation stimulate transport demand, while motorised private road transport gains market share over non-motorised modes and public transport. Depending on landscape, climate, hydrology, economic structure, and urban form all kinds of environmental external effects may occur in such an expanding city, e.g. pollution of the air, soils, and water, as well as noise and degradation of natural habitats.

There is an ongoing discourse in spatial economics about what constitutes optimal city size (e.g. Arnott, 2004, Capello, 2000, Kanemoto et al., 1996). The number of theoretical and conceptual contributions is much larger than actual applications to cities (Kanemoto et al., 1996, is a rare example). Furthermore, for a long living system such as a city static optimality is of little value, instead the best possible resilient pathway over time is more important.

Next to existing economic and geographic models there are also approaches based on physical concepts such as material flow analysis (MFA), in which the city is described as a metabolic system (Moll et al., 2005), and entropy models of urban systems (Zhang et al., 2006). These studies indicate that a fully fledged treatment of sustainability will probably change the assessment and judgement for many cities, but they stop short of providing an alternative assessment system. Furthermore, these studies often focus on one particular aspect, e.g. transport.

Since spatial dynamics embodies very complicated processes neither consumers nor producers can fully grasp the longer term consequences of their location choices. When cities start to attain larger sizes and external effects start to become noticeable, a spatial development which is mostly based on individual private decisions (and interests) has a very high risk to acquire ever more features that weaken the social and environmental realm of sustainability. In turn the degradation of these realms eventually undermines the economic sustainability, either because problems arise at the input side (lack of natural resources, extra cleaning cost, lack of skilled labour) or at the output side (new emerging sectors choose other cities, skilled workers migrate to better paying regions). In other words the maintenance of agglomeration effects requires also sufficient sustainability in the social and environmental realm.

All in all sustainable urban economics, which also accounts for the interaction with the social and environmental realm, would imply in this context that a city or city region succeeds in

- keeping up already strong sectors for considerable time by facilitating cost efficiency and innovativeness, but prevent that the city's resources get wound up in once strong activities with structurally low productivity,
- fostering new sectors with substantial growth potential so as to promote diversification, to facilitate cross-fertilisation in innovations, and to prepare for shifts out of declining sectors,
- devising funding structures for adequate public services and infrastructures that sustain the changes in economic, demographic and spatial structure, and suffice to create attractive, healthy, and safe living and working environments with minimal environmental footprints.

Economic criteria and indicators

The proposed set is preliminary, limited by data availability and lack of use experience. In a learning-by-doing-process, including generation of new data, the set will evolve over time. The indicator sets are subdivided in four sections, which typically represent the key dimensions that drive economic sustainability. The first two dimensions, productivity and regeneration, deal with economic core elements. The next two dimensions, public infrastructure and environmental effects deal with important facilitating and conditioning elements for promoting economic prosperity and overall sustainability.

1. The economic life and the development of it's sectors is productive and profitable

- Economic growth supports sustainable development (region's GDP development, degree of concentration in few sectors)
- Supply of employment is diverse (employment by sector, employment by sector by municipality)
- Purchasing power grows in all sectors (purchasing power of households, purchasing power of households per municipality)
- Housing market is in balance (housing prices and rents per m², share of rental apartments of all apartments, available rental apartments)
- Municipal tax rates and indebtedness of the urban region is moderate (region's municipal tax rates for income and real estate tax, municipal indebtedness and it's growth)

2. Economic life of the urban region is capable of regeneration

- Development of labour meets the demand (municipal self-sufficiency rate of employment, labour population by age category, rate of unemployed and people outside labour to employed in municipalities)
- Labour is mobile and enterprise structure is dynamic (job vacancies, new company establishments and company closures)
- Productive capacity of the urban region regenerates (private investment's share in GDP, region's research and development effort)

3. Infrastructure and other public services in the urban region are adequate and working

- Public transport is efficient (supply (frequency) of public transport connections, public subsidy of public transport/trip)

4. *Environmental impacts of economy are as small as possible*

- Energy efficiency of the urban region is getting better (energy consumption in public buildings, region's electricity consumption per capita)
- Climate impacts of the urban regions and environmental load of industries are small or getting smaller (region's greenhouse gas emissions, region's production of renewable energy, industrial energy consumption)
- Basic material flows are ecologically sustainable (recycling rate of municipal waste, landfill waste)

Pilots

Two urban regions, Lahti in southern Finland and Oulu in northern Finland were involved in the development of the sustainability criteria and indicators. All indicators were tested in these two pilot regions which differ remarkably from each other both physically and functionally. The results were presented to urban planners and decision-makers and discussed with them. Local knowledge was valuable in the development work for assessing the validity and usability of analyses and results. All results will be presented in the forthcoming final report of the project with map representations together with tables and graphs.

4. Discussion and Conclusions

The criteria and indicators developed in the Seutukeke project describe sustainability and sustainable communities from different angles. They can be used at different phases of land use planning ranging from objective setting to impact assessment and further to monitoring. The large amount of indicators does not mean that all of them should be applied in every planning case. Instead of that, a suitable set of indicators can be selected and further analyzed, or the whole set of indicators can be used as a check list in impact assessment scoping phase.

However, there are certain challenges related to the use of indicators: adequate and valid data, proper scale of an analysis and suitable and right use of results as a part of the planning case. These challenges, as well as further development of criteria and indicators, are in the core of our future research activities. Some of the criteria and indicators have been used in a real world planning case in the city of Lahti in early 2011 and an assessment of Päijät-Häme regional plan and strategy with Seutukeke indicators is also under preparation. In the future the development of indicators is heavily dependent on planners' experiences. The criteria and indicators will be published in Finnish as a final report in late 2011. The report can be used as a guidance book in concrete land use and transport planning. Detailed information on GIS analysis and ecological criteria will be presented in separate special guidance reports.

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BIOREFINERY IMPLEMENTATION IN MARGINAL LAND- A FOCUS ON THE MULTIFUNCTIONAL USE OF REGIONAL AGRICULTURE.

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ABSTRACT – *In times of depletion of fossil resources and increasing environmental concerns, more focus needs to be placed on energy and materials co-production patterns. The search for new sources of energy is often leading to intensified use of available land for energy cropping in competition with food production, although recent studies show that land conversion from forest, savannah and grassland into biofuels crops causes significant increases of CO₂ emissions. Within the EU funded SMILE project, an alternative design for marginal land use in central-southern Italy was hypothesized by assuming marginal lands to be cropped with Brassica carinata, a non-food crop, for biodiesel production from seeds and, at the same time, biochemicals extraction from residues. The actual potential of the biorefinery concept applied to marginal or abandoned lands was deeply investigated. The effectiveness of an expanded LCA approach, named SUMMA (Sustainability Multimethod Multiscale Assessment), based on the consistent application of different assessment methods to the input and output inventory of local processes, was tested by means of the comparison of two different scenarios (bioenergy approach versus biorefinery approach). A further integration within the SUMMA method consisted in a specific spatial parameterisation by means of Geographic Information System (GIS) procedures. Results achieved show that the energy and environmental performance of biodiesel and heat generation from Brassica residues is unlikely to be profitable and desirable at the level of Campania regional agriculture, due to the fact that the economic cost of the whole process largely exceeds the value of the saved fossil fuels. If straw and oilseed cake meals are accounted for, in addition to the biodiesel production, the performance results to be higher from an energetic point of view, but the process is still not fully satisfactory in economic and environmental terms. Instead, if agricultural residues are exploited for the extraction of chemical building blocks, through the so-called Biofine process or other biorefinery patterns, the performance is improved, thanks to the high added value of generated biochemicals.*

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1. Introduction and Background

The development of large scale industrial production systems based on renewable resources, rather than non-renewable ones, is a crucial item on the international agenda, in times of increasing depletion of fossil reservoirs. In such a framework, biomass and, in particular, plant-based raw materials are of great interest from both economic and ecological standpoints as alternative feedstocks for industrial production, addressing both the energy and non-energy sectors including chemicals and materials (EC, 2004).

The search for new sources of energy and materials gave rise to an intensified exploitation of available land for energy cropping: energy cropping is however constrained by the large amount of soil required for the production of raw materials. Soil use as well as other related environmental resources (water, topsoil, biodiversity etc.) affected by energy cropping are source of growing concerns about environmental, ecological and social impacts.

In order to prevent competition for arable lands in food production, non-food crops on marginal lands have recently been promoted, where “marginal” refers to abandoned or degraded lands with low inherent productivity and no quality for agricultural uses (UNEP, 2007). Cropping bioenergy can overcome these lands’ economically unattractiveness and unsuitability for food production. In Campania region (southern Italy), a significant portion of lands can be considered marginal because of insufficient economic return and also serious pollution level generated by inaccurate or illegal disposal of industrial and urban waste. As a consequence, growing non-food crops may provide an extraordinary opportunity to add value to these idle lands, producing both bioenergy and biomaterials in the wider perspective of the biorefinery concept, intending for biorefinery “the sustainable processing of biomass into a spectrum of value-added products (chemicals, materials, food and feed) and energy (biofuels, power and heat)” (Kamm & Kamm, 2004, 137-145).

In the present study, within the EU funded SMILE project, *Brassica carinata* was chosen as a likely non-food crop suitable for biodiesel production and biochemicals extraction in Campania region, thanks to the perfect overlapping of climate conditions and cultivar constraints. Two alternative scenarios were explored: cropping *B. carinata* on marginal lands of Campania region for energy purpose only or within the biorefinery perspective of energy, biomaterials and biochemicals. Environmental, energetic, economic, technological and social aspects were assessed by means of an expanded LCA approach, named SUMMA (SUstainability Multimethod Multiscale Assessment). The capability of the evaluation framework adopted in accounting for crucial steps and performances of the agricultural process on the territory was incremented by combining the full view of the extended LCA with the visualization power of GIS (Geographic Information System).

2. Material and Methods

Brassica carinata

The selection of the crop is crucial. Several criteria need to be considered: potential yield per hectare, adaptation to climate conditions, field requirement (fertilizers, pest and weed control), biomass characteristics, potential use, among others (EPOBIO, 2007). *B. carinata* was herein chosen because

capable of self-adapting to agro-pedo-climatic conditions of selected area and also for its low agricultural demand and potential use as a source of bioenergy and biomaterial products (Mazzoncini *et al.*, 1999, 55; FAIR Final Report, 2000). According to published experimental tests (De Mastro *et al.*, 2009, 134-196), *B. carinata* can be cropped using different intensity systems, i.e. low and high inputs (LI and HI), depending on expenditures of technical means, soil tillage, fertilizers and chemical treatments. We are not advocating a *Brassica* monoculture in Campania. The rationale is that *Brassica* based results of our simulation are likely to be considered the upper performance limits for bioenergy and biorefinery programmes in marginal land.

Case study area

A spatial analysis was conducted using the Geographic Information System (GIS) software ArcGIS v. 9.3 for estimating the distribution and availability of marginal lands in Campania region. The expression “marginal land”, even if not univocally defined (UNEP, 2007), comprises all non-cultivated areas where actual primary production is too low to allow competitive agriculture. The selection of marginal lands suitable for cropping *B. carinata* was based on the integration of different GIS data. In particular, the non-irrigated arable lands from the third level of CORINE LAND COVER (2006) were overlaid on the areas declared polluted by ARPAC (2008). Assuming in this way that *B. carinata* is cropped only in the areas that are both non-irrigated and contaminated from previous inaccurate management, the considered hectares amounted to 44,998 (Figure 1).

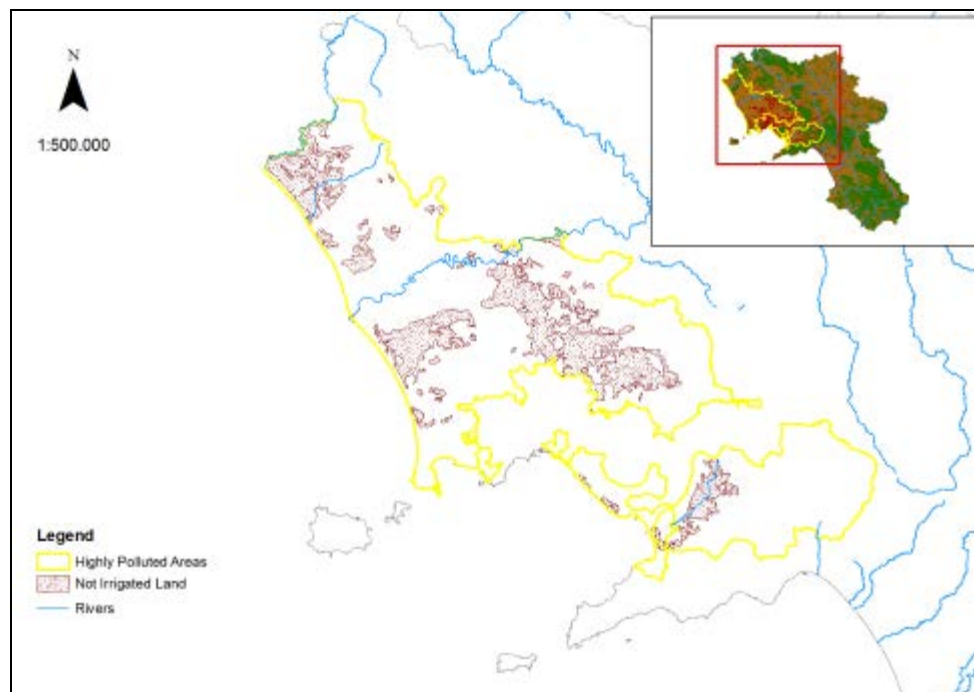


Figure 1. Selection of marginal lands suitable for cropping *B. carinata* based on the integration of different GIS data (44,998 ha).

3. Case Studies

Two alternative scenarios were explored: cropping *B. carinata* only for energy in polluted and marginal land and cropping for both energy and biomaterials in non-polluted but still marginal land.

1. *Bioenergy approach*

In this first case study, production of biodiesel was taken into account together with heat generation by combustion of residues. The oil derived from the defatted seeds of Brassicaceous plants, characterized by a high content in erucic acid, is of no interest for food purposes but can find several applications including the production of biofuels. The oil extracted from seeds is converted to biodiesel through a trans-esterification process (seed oil + MeOH + KOH → biodiesel + glycerol). At the same time, agricultural residues of *B. carinata*, i.e. straw from the field and press cake from the industrial step of oil extraction, can be dried and burnt in local industrial boilers in order to produce heat without much transportation expense. Four main steps are considered in the evaluation: agricultural production, transport of seeds to the conversion plant, oil extraction and finally biodiesel and heat production. The assessment was carried out considering the operative times and specific fuel consumption of the different typologies of machinery used as well as the inputs of fertilizers and pesticides. The transport of seeds to the biodiesel plant for processing is a crucial aspect of the assessment, since the distance between the site of cultivation and the site of processing might significantly affect the process performance and should be kept to a minimum.

2. *Biorefinery approach*

In the second case study, the biorefinery concept was applied to *B. carinata* crop in order to optimize its exploitation. The conversion of lignocellulosic material into biochemicals according to the so-called Biofine concept (Hayes *et al.*, 2005, 139-164) was considered as an additional step to the previous scenario, although other typologies of biorefinery patterns are also possible. Lignocellulosic materials consist of three primary chemical fractions or precursors: (a) hemicellulose/polyoses, sugar polymer of predominantly pentoses, (b) cellulose, a glucose polymer and (c) lignin, a polymer of phenols. The Biofine process is a commercial example of acidic hydrolysis process to treat lignocellulosic agricultural residues in order to extract ethyl levulinate (EL), levulinic acid (LA), and formic acid (FA) as a byproduct of LA formation from C6 sugars derived from cellulose. The process consists of two steps operating at 200°C. The first step generates hydroxymethylfurfural (HMF) and furfural (2-FA) as products respectively from the dehydration of C5 and C6 sugars. In the second step, HMF and 2-FA are converted into LA and FA. LA and 2-FA are important chemical platforms, easily exchangeable into several useful products of modern chemical industry (solvents, pesticides, polymers and pharmaceuticals). Given the assumption that the same amount of land is cropped with *B. carinata* as in the bioenergy approach case study, agricultural, transport and biodiesel production steps are assumed to have the same input costs and performance indicators. The additional step, namely the pre-treatment and conversion of lignocellulosic material into biochemicals, entails new input costs and emissions, that are calculated by means of the same evaluation approach. The biorefinery

land is assumed marginal but not polluted, in order to allow the use of some products in non-combustion processes.

Assessment Tools – Geographic Information System (GIS) and Extended LCA (SUMMA)

To better evaluate the system's performance, the integration between the SUMMA approach (Ulgiati *et al.*, 2006, 432-442) and the Geographical Information System (GIS) was accomplished. The use of the GIS method for handling the spatial collected data produces site-specific information, thus allowing a more accurate extended LCA (Bengtsson *et al.*, 1998, 67-75; Jäppinen *et al.*, 2008). In fact, Geographic Information Systems have emerged as effective and powerful tools to store, analyse and visually present environmental data. GIS can be defined as a combination of hardware, software, data, people, procedures and institutional arrangements for collecting, storing, manipulating, analyzing and displaying information about spatially distributed phenomena for the purpose of inventory, decision making and/or problem solving within operations, management and strategic contexts as related to issues at hand (Nyerges and Jankowsky, 2010). In simple terms, GIS is the merging of cartography, statistical analysis and database technology. For both the case studies analysed, GIS has been applied to quantify the hectares in Campania region actually showing appropriate agro-pedoclimatic parameters and suitable characteristics for *B. carinata* cropping.

The feasibility of bioenergy and biorefinery production systems from *B. carinata* needs an assessment in terms of environmental and economic performances. Environmental evaluation procedures proposed so far by many authors (energy analysis, ecological footprint, etc) have offered valuable insights in different aspects of resource conversions and use, but each method only supplies a piece of information about a system's performance at a specific scale. Integration of different methods can instead supply an overall picture, thus providing an "added value" that could not be achieved by each individual approach. Moreover, conventional LCA only provides information about the resource and environmental cost of a given product, accounting for matter and energy flows under human control, whereas flows such as environmental services, labor, culture and information as well as economic flows are not generally included. When sustainability comes into play as a major concern, these flows are relevant and cannot be disregarded. To this purpose, emergy evaluation becomes decisive and expands the focus of LCA by considering the contribution given by environmental flows to a system/process sustainable dynamics (Ulgiati *et al.*, 2011, 168-176). In fact, all resources are referred to the scale of biosphere and their usefulness and quality are quantified on the same value basis and then compared with the product(s) generated. Such considerations lead to an extended LCA, named SUMMA (SUstainability Multi-criteria Multi-scale Assessment), developed by Ulgiati *et al.* (2006, 432-442; 2011, 168-176), that synergically merges both upstream methods, such as the Material Flow Accounting (Schmidt-Bleek, 1993, 407-412; Hinterberger and Stiller, 1998, 275-286/642; Bargigli *et al.*, 2004, 439), the Embodied Energy Analysis (Slesser, 1978; Herendeen, 1998, 13-48) and the Emergy Accounting (Odum, 1988, 1132-1139; Odum, 1996; Brown and Ulgiati, 2004, 201-213), and downstream impact assessment methods (e.g., the CML2 baseline; Leiden, 2000), that stem from stoichiometric evaluations or measures of output airborne, waterborne and solid waste chemical releases for the identification and characterization of specific impact categories. Therefore, SUMMA allows to obtain a more exhaustive picture of process performance and sustainability, including an assessment of different viewpoints

(methodological, spatial and time-scales). The analytical calculation procedures used in this study are described elsewhere (Fahd *et al.*, 2010, in press).

4. Results

The final performance indicators for the agricultural and industrial steps of the first case study are provided in Table 1. It includes results from all the different methods applied within the SUMMA framework to a low input *Brassica* cropping. Analogous assessments were made also for high input cropping (data not shown). Indicators in the Table are intensity indicators, i.e. indicators per functional unit of product generated, with products measured according to their energy content, mass and economic value, when applicable. As always in the SUMMA procedure, the Table is divided into four main categories of indicators: Material Resource Depletion (abiotic material depletion and water depletion); Energy depletion (given as embodied energy use); demand for Environmental Support (emergy); Downstream Impacts (Global Warming Potential, Acidification Potential, Eutrophication Potential). Within the category of Energy Indicators, the Energy Yield Ratio, the Environmental Loading Ratio, the Emery Sustainability Index and the % Renewable Emery are also calculated.

Regarding the material resource depletion, the highest values, in terms of both abiotic material and water use, were calculated for *Brassica* oil extraction and biodiesel production. In a like manner, the requirements causing higher energy resource depletion were found for *Brassica* oil (0.29 g oil equiv.) and for biodiesel (0.50 g) in comparison to only 0.07 g oil equivalent needed to make one g of seeds. Therefore, half a gram of oil is invested to generate 1 g of oil equivalent energy. This means that the net energy delivered to society is only 50% of the total yield and that two hectares are needed in order to make one “net hectare”. The energy return on the energy investment (EROI) ranges from 8.81:1 for seeds to 1.81:1 for biodiesel. Although the energy delivered is slightly higher than the energy invested, such a result is largely inadequate to support the energy intensive production processes of our society, compared to the EROI of refined fossil fuels (in the range 5-6:1). Considering the demand for environmental support (Emery Intensity), the transformity calculated for biodiesel (3.11E+05 seJ/J) is 70% higher than for fossil diesel (1.81E+05 seJ/J, Brown *et al.*, 2011, 879-887), indicating that biodiesel is three times more demanding in terms of global biosphere support (environmental inputs, land, water, indirect factors, etc). Additionally, the EYR (total emery exploited/emery invested from outside) is an indicator of the ability of the process to make new resources available per unit of investment and the value found for biodiesel (1.14:1) is very low compared to fossil fuels (presently around 10:1). This means that fossil fuels provide to the economy a net contribution of resources that is much higher than that supplied by bioenergy processes. Moreover, emissions of CO₂ and other greenhouse gases are relatively low (0.13 g CO₂ per g dry seed) in the seeds production, whilst in the oil extraction and biodiesel production emissions grow to 0.63 and 1.24 g CO₂ per gram of oil and biodiesel, respectively, as a consequence of the high direct and indirect demand for energy, without considering the emissions released by the use of the generated fuel.

Data calculated in terms of energetic and economic evaluations are reported respectively in Table 2 and Table 3. In general, the energy content of biomass or biofuel does not indicate the net energy that is actually available to the larger economic system, because there is an investment of energy embodied in the production factors (fertilizers, machinery, fuel) that needs to be subtracted. Besides the Energy

Invested for a process, Table 2 shows the calculated values of Usable Energy Delivered (UED), namely how much (gross) energy is actually provided to the user, after all energy losses and transportation expenses are subtracted; the Table also shows the Net Energy Delivered (NED), i.e. how much energy is actually gained by the society from the process (thanks to the photosynthetic energy fixation), after all energy expenses for production are subtracted. The high intensity mode of cropping, although providing 25% more UED, delivers only 7% more NED than the low intensity mode, due to the much higher input energy costs.

Table 1. Upstream and Downstream SUMMA indicators for Biodiesel chain (LI Brassica cropping).

Indicators	Seeds	Straw	Brassica oil	Cake meal	Biodiesel	Glycerine
Material resource depletion						
MI abiot (g/g)	0.76	0.50	2.08	0.93	2.68	1.19
MI abiot (g/J)	2.76E-05	2.76E-05	5.55E-05	5.55E-05	7.14E-05	7.14E-05
MI abiot (g/€)	2.17E+03	2.52E+04	4.72E+03	2.17E+03	3.42E+03	1.13E+04
MI water (g/g)	3.25	2.16	19.05	8.56	27.56	12.20
MI water (g/J)	1.18E-04	1.18E-04	5.09E-04	5.09E-04	7.35E-04	7.35E-04
MI water (g/€)	9.30E+03	2.04E+02	4.33E+04	1.99E+04	3.52E+04	1.16E+05
Energy resource depletion						
GER per unit mass (J/g)	3.13E+03	2.08E+03	1.20E+04	5.39E+03	2.08E+04	9.19E+03
GER per energy (J/J)	0.11	0.11	0.32	0.32	0.55	0.55
GER per unit currency (J/€)	8.95E+06	1.04E+08	2.72E+07	1.25E+07	2.65E+07	8.75E+07
Oil eq (g oil/g)	0.07	0.05	0.29	0.13	0.50	0.22
Oil eq (g oil/J)	2.71E-06	2.71E-06	7.66E-06	7.66E-06	1.32E-05	1.32E-05
Oil eq (g oil/€)	2.14E+02	2.48E+03	6.51E+02	2.99E+02	6.33E+02	2.09E+03
EROI	8.81	8.81	3.12	3.12	1.81	1.81
Emergy (demand for environmental support)						
Specific emergy (seJ/g)	2.98E+09	1.05E+09	1.04E+10	5.89E+09	1.17E+10	1.17E+11
Transformity (seJ/J)	1.08E+05	5.75E+04	2.77E+05	3.51E+05	3.11E+05	7.02E+06
Emergy money ratio (seJ/€)	8.51E+12	7.51E+13	n.a	1.37E+13	1.49E+13	1.11E+15
EYR	1.17	1.17	1.15	1.15	1.14	1.14
ELR	6.39	6.39	7.41	7.41	8.28	8.28
ESI	0.18	0.18	0.16	0.16	0.14	0.14
% Renewable	0.14	0.14	0.12	0.12	0.11	0.11
Downstream impact assessment						
Global warming (g CO ₂ -equiv/g)	0.13	0.09	0.63	0.28	1.24	0.55
Global warming (g CO ₂ -equiv/J)	4.77E-06	4.77E-06	1.68E-05	1.68E-05	3.30E-05	3.30E-05
Global warming (g CO ₂ -equiv/€)	3.76E+02	4.35E+03	1.42E+03	6.55E+02	1.58E+03	5.21E+03
Acidification (g SO ₂ /g)	4.92E-04	3.27E-04	1.85E-03	8.31E-04	3.92E-03	1.73E-03
Acidification (g SO ₂ /J)	1.78E-08	1.78E-08	4.95E-08	4.95E-08	1.05E-07	1.05E-07
Acidification (g SO ₂ /€)	1.41	16.30	4.21	1.93	5.00	16.50
Eutrophication (g PO ₄ /g)	4.82E-05	3.19E-05	1.97E-04	8.85E-05	4.10E-04	1.82E-04
Eutrophication (g PO ₄ /J)	1.74E-09	1.74E-09	5.27E-09	5.27E-09	1.09E-08	1.09E-08
Eutrophication (g PO ₄ /€)	0.14	1.60	0.45	0.21	0.52	1.73

Comparing with energy uses in Campania region and Campania agriculture, bioenergy from marginal lands only covers a small amount of the energy demand and these results cannot be significantly improved by increasing the cropping intensity (machinery, fertilizers).

Concerning the economic assessment, the required investment consists of both direct and indirect labor (services) and it does not include the cost of fuels used nor other costs for indirect fossil energy saved, because a fraction of the energy delivered is assumed to feedback the production process in order to make it independent from fossil energy input (a pre-condition for process sustainability).

Table 2. Energetic evaluation for low and high input B. carinata cropping systems. Data are calculated for biodiesel production and heat generation by combustion of straw and cake meal, considering the total selected area (44,998 ha).

	Energy Invested for process (J/yr) (a)	Usable Energy Delivered (J/yr) (b)	Net Energy Delivered (J/yr) (b-a)	Ratio b/a
Low Input	7.87E+14	1.74E+15	9.56E+14	2.21
High Input	1.30E+15	2.33E+15	1.03E+15	1.79

The total NED from Table 2 corresponds to 22,800 t of oil equivalent in the case of low intensity cropping and to 24,700 t of oil equivalent in the case of high intensity cropping (1 t oil equivalent = 4.186E+10 J). Considering that the average oil cost was 61.25 €/barrel (0.45 €/kg in the year 2010, www.oil-price.net), it is possible to calculate the saving rate of economic investment in terms of fossil fuel not used. As shown in Table 3, the net economic balance is negative for both low and high input cropping systems and the economic investment required is respectively 3.83 and 4.24 times higher than the economic savings associated to the oil not used thanks to the NED in the form of biodiesel and heat.

Table 3. Economic evaluation for low and high input B. carinata cropping systems. Data are calculated for biodiesel production and heat generation by combustion of straw and cake meal, considering the total selected area (44,998 ha).

	Economic investment (€/yr) (a)	Saving rate of economic investment of produced energy (€/yr) (b)	Net Economic (€/yr) (b-a)	Ratio a/b
Low Input	3.97E+07	1.04E+07	-2.94E+07	3.83
High Input	4.75E+07	1.12E+07	-3.63E+07	4.24

The poor energetic and economic performance achieved within the previous case study is the starting point of the biorefinery approach. The worth of biorefinery processes relies in their ability to exploit a larger fraction of available substrate and generate higher value added products than just energy. Such products seem to be potentially capable of providing higher income and energy replacement value (indirect energy savings from alternative fossil-based chemistry). The enhanced economic performance of a biorefinery compared to a bioenergy system was verified previously (Fahd *et al.*, 2011, submitted) but it is not shown here: considering the total economic income from a biorefinery chain including several chemical products that can be separated and sold to the market, the economic investment needed results to be lower (the ratio of gross income to costs is about 1.8:1). While cropping for

bioenergy requires around 4 times higher economic cost than income, cropping within a biorefinery perspective is potentially rewarding and offers a perspective for future improvement. Therefore, in the second case study, the SUMMA method was used as an assessment tool capable of evaluating not only the technical feasibility but also the economic and environmental profitability of the biorefinery approach. Table 4 lists the calculated performance indicators and impacts for the main products of the designed *Brassica*/Biofine biorefinery, namely ethyl levulinate, formic acid, biodiesel and glycerine.

The abiotic material and water demands are higher for ethyl levulinate and biodiesel than for glycerine and formic acid. Formic acid and glycerine are in fact produced in very small amounts compared to the main products and therefore require a lower fraction of material allocation. The same occurs in the case of the embodied energy demand (0.76 and 0.50 g oil equivalent per g of ethyl levulinate and biodiesel respectively, much larger than for formic acid and glycerine). Furthermore, energy results for biochemicals (in the range of 0.3-0.9 J embodied per J of product) are of the same order of magnitude as biodiesel and glycerine and much lower than average results for petrol-chemicals, reported to be in a range of 1.5-3 J embodied per J of product (Patel, 2003, 721-740). In terms of oil equivalents, one euro of income from these products requires 841 g of crude oil for ethyl levulinate and formic acid, only 633 g for bioethanol and 2090 g for glycerine. Finally, it is noteworthy that transformities of ethyl levulinate ($9.78\text{E}+07$ seJ/J) and formic acid ($1.50\text{E}+09$ seJ/J) are much larger than for biodiesel ($3.11\text{E}+05$ seJ/J) and glycerine ($7.02\text{E}+06$ seJ/J), in so reflecting the smaller amounts produced compared to a higher energy investment.

Table 4. Main indicators from LCA/SUMMA evaluation of the Brassica/Biofine Line.

Indicators with L&S	Ethyl Levulinate	Formic Acid	Biodiesel	Glycerine
Material resource depletion				
MI abiot (g/g)	3.72	0.31	2.68	1.19
MI abiot (g/J)	1.02E-04	3.77E-05	7.14E-05	7.14E-05
MI abiot (g/€)	4.13E+03	4.13E+03	3.42E+03	1.13E+04
MI water (g/g)	21.35	1.77	27.56	12.20
MI water (g/J)	5.86E-04	2.16E-04	7.35E-04	7.35E-04
MI water (g/€)	2.37E+04	2.37E+04	3.52E+04	1.16E+05
Energy depletion				
GER per unit mass (J/g)	3.17E+04	2.63E+03	2.08E+04	9.19E+03
GER per energy (J/J)	0.87	0.32	0.55	0.55
GER per unit currency (J/€)	3.52E+07	3.52E+07	2.65E+07	8.75E+07
Oil eq (g oil/g)	0.76	0.06	0.50	0.22
Oil eq (g oil/J)	2.08E-05	7.67E-06	1.32E-05	1.32E-05
Oil eq (g oil/€)	841	841	633	2090
EROI	1.12	0.07	1.81	n.a.
Energy (demand for environmental support)				
Specific energy (seJ/g)	3.56E+12	1.23E+13	1.17E+10	1.17E+11
Transformity (seJ/J)	9.78E+07	1.50E+09	3.11E+05	7.02E+06
Energy money ratio (seJ/€)	3.95E+15	1.64E+17	1.49E+13	1.11E+15
EYR	1.00	1.00	1.14	1.14
ELR	56.63	56.63	8.28	8.28

ESI	0.02	0.02	0.14	0.14
% Renewable	2%	2%	11%	11%
Climate change				
Global warming (g CO ₂ -equiv/g)	2.33	0.19	1.24	0.55
Global warming (g CO ₂ -equiv/J)	6.40E-05	2.36E-05	3.30E-05	3.30E-05
Global warming (g CO ₂ -equiv/€)	2.59E+03	2.59E+03	1.58E+03	5.21E+03
Acidification (g SO ₂ /g)	9.12E-03	7.57E-04	3.92E-03	1.73E-03
Acidification (g SO ₂ /J)	2.50E-07	9.24E-08	1.05E-07	1.05E-07
Acidification (g SO ₂ /€)	10.10	10.10	5.00	16.50
Eutrophication (g PO ₄ /g)	8.91E-04	7.40E-05	4.10E-04	1.82E-04
Eutrophication (g PO ₄ /J)	2.45E-08	9.03E-09	1.09E-08	1.09E-08

5. Discussion and Conclusions

The energy and environmental performance of bioenergy (biodiesel and heat) production chain from *B. carinata* was found to be hardly suitable at the level of Campania regional agriculture, due to the fact that the economic cost of the whole process exceeds the value of the saved fossil fuels, even if heat from combustion of straw and oilseed cake meals are accounted for in addition to the biodiesel production. Results show that the net profit is very small in energy terms and that there is no profit at all in economic terms. Instead, if agricultural residues are exploited for the extraction of chemical building blocks, such as ethyl levulinate and formic acid, both the energy and the economic balances are improved, due to the high added value of biochemicals. In the biorefinery case, biofuels result to be less affected by economic unfeasibility: if residues are considered as still useful substrates, the viability of a bio-based process increases. Furthermore, by converting waste and residues (also from food manufacturing industry and urban systems) into value added chemicals, combustion and landfilling are avoided and additional energy, economic and environmental burdens are prevented, making the benefit from the biorefinery line even larger. The entire utilization of agricultural residues in order to extract both bioenergy and bioproducts within a biorefinery concept definitely improves the environmental and economic performance of bio-based feedstocks. The biorefinery option, in fact, takes advantage of the largest market value of biomaterials and of the need for proper disposal of agricultural and agro-industrial residues. Nevertheless, it is still dependent on fossil fuel inputs and therefore not easily decoupled by the trade-off of economic costs, energy demand and land availability. The economic feasibility is thus driven by the still low fossil energy cost as well as by the inclusion as credits of the savings generated by having identified a profitable alternative to agro-industrial waste disposal. To avoid, or at least decrease, the fossil fuels dependence, the production process needs to be redesigned through a major integration among different steps, minimizing transportation expenses and exploiting the locally available resources (bio-fertilizers, additional residues, potential users of the products).

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SUPPORTING SUSTAINABLE DEVELOPMENT: USING THE SMILE TOOLKIT WITH STAKEHOLDERS IN SCOTLAND

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ABSTRACT – *This paper reflects on using the SMILE toolkit with stakeholders, namely staff members from the Cairngorms National Park Authority (CNPA). The paper considers applying these tools and the response of potential end-users, in the context of literature on evaluating the use of such tools. Therefore, the paper explains the rationale for undertaking a utility evaluation; provides the context for our application; presents the findings to date; and illustrates what lessons have been learnt. This paper follows the tradition of stakeholder participation in generating, refining and using tools and describes the challenges that arise. The paper focuses on the role of the researcher(s) as a process manager, constantly facilitating this process of evaluation, refinement and application; and the relationships within the case study (Sterk et al., 2006). Models play a heuristic role to help multiple stakeholders understand complex systems; a symbolic role in making issues visible to politicians and a relational role by creating a boundary object around which a social network can be developed. It is interactive learning that facilitates these roles; and the practice of working with models can be improved (Sterk et al., 2009).*

1. Understanding Utility

There are a series of interdependent problems to be overcome if research based tools are to be useful for, and used by, policy makers and managers. Utility links the outputs of research (knowledge embodied in peer reviewed articles, software or datasets) to outcomes (changes in values, attitudes and behaviour in the world beyond the research institute). Evaluation literature has increasingly focused on understanding how and under what conditions outputs from processes are interpreted and can result in outcomes (Blackstock et al. 2007; Patton 1998). Tools follow three loosely coupled adaptive cycles – research, development and operations (after McCown, 2002a). The Research phase (the left column in **Error! Reference source not found.**) is concerned with developing new theories, methods and tools e.g. the DECOIN project. In the Development phase, activities undertaken may resemble those of the Research phase but are differentiated by being action oriented, having a primary concern for outcomes rather than academic innovation (Argyris et al. 1985) e.g. our SMILE case study. The Operations phase is where the knowledge is used within the social processes of government, regulation, markets and media by a wider range of stakeholders (this lays beyond the scope of SMILE).

It is possible to identify five preconditions for utility: validation, salience, interpretability, reliability and usability. **Validation** defines the criteria used in the choice of an “acceptable” model, and then testing the model performance according to those criteria (Bellocchi et al. 2010). Validation can significantly enhance the credibility of model outputs (Carberry et al. 2002) but is hard to achieve if data cannot be directly measured, where the systems are very large and/or very complex or where validation would raise ethical concerns (Giampietro 2004). **Salience** means that a tool should address the issues of most interest to the stakeholders. Deciding on the scope and focus of an application requires an ongoing partnership between developers and the stakeholders (Van Ittersum et al. 2008). However, these choices may change between phases (research, development, operations)- reconciling the supply from the Research phase with the demand from the Operational phase is a serious challenge (McNie 2007). **Interpretability** is the degree to which the outputs of the tools can be understood by the relevant stakeholders. Interpretability requires clarifying the assumptions being made and how the compromises in translating reality into formalism affect the outputs. Generally, the developer acts as an intermediary to help explain the outputs within the social processes of decision making and policy (Carberry et al. 2002). **Reliability** is assessed through software quality control from simple debugging to larger structured processes of software testing (Britton & Doake 1996) and can be automated to benchmark systems (Hutchins et al. 2006). Such evaluations typically focus on the quality assurance of outputs rather than assessing the outcomes of tool use. **Usability** is the ease (and thus efficiency) with which a tool can be applied to a new problem. However, overly simplified user interfaces may detract from the credibility since they may reduce the transparency of complex analyses (McCown et al. 2006). **Utility** is relates to how useful the outputs are for achieving Operational phase outcomes, in the view of stakeholders. It has been argued that the stakeholder perceptions of utility are more influential in determining the outcomes of than later verifications of utility (Diez & McIntosh 2009). The implementation gap between development and operational use phases is widely recognised (McIntosh et al. 2008). Both stakeholders and developers of tools need to be realistic in agreeing what can be achieved for the resources being invested.

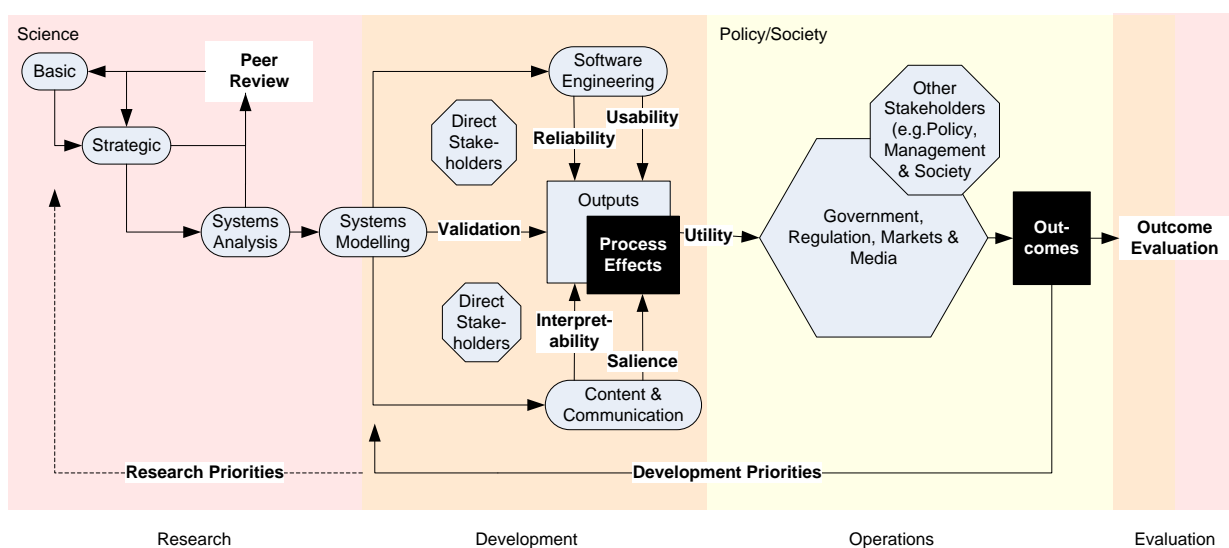


Figure 5. Conceptual framework for assessing the utility of software tools

2. Overview of the SMILE toolkit

The Synergies of Multi-Level Integrated Linkages in Eco-social Systems (SMILE) project seeks to implement a set of models from the ongoing DECOIN project. The DECOIN tool kit (<http://www.smile-fp7.eu/deliverables/SMILE%20D3.pdf>) consists of three bio-economic accounting methods that work at multiple levels over time, to illustrate trajectories of development. It focuses on the concept of social metabolism that draws attention to how energy, material, money and ideas are utilised by society. The first, ASA (Advanced Sustainability Analysis); will not be discussed as it is not being applied in our case study. The other two are MUSIASSEM (Multi-Scale Integrated Analysis Societal Ecosystem Metabolism) and SUMMA (Sustainability Multi-criteria Multi-scale Assessment). MUSIASSEM calculates relationships between extensive variables (stocks) of land and human labour, which create flows of money, energy and materials expressed in intensity ratios (Giampietro & Mayumi, 2000). SUMMA is an empirically based set of co-efficients that also consider how stocks create, and are created by, flows of money, energy and materials through the system. These flows are expressed as emergy to illustrate the embodied energy and materials being utilised by the system (Brown & Ulgiati, 2004). SUMMA and MUSIASSEM were applied at the Scotland (N+1), Cairngorms (N) and within-Cairngorms (N-1) level. SUMMA was specifically applied to the agricultural sector, whilst MUSIASSEM was applied to the whole system. For more information on results regarding growth; trade-offs; and policy implications see reports D28 – 30 (available <http://www.smile-fp7.eu/?id=deliverables>).

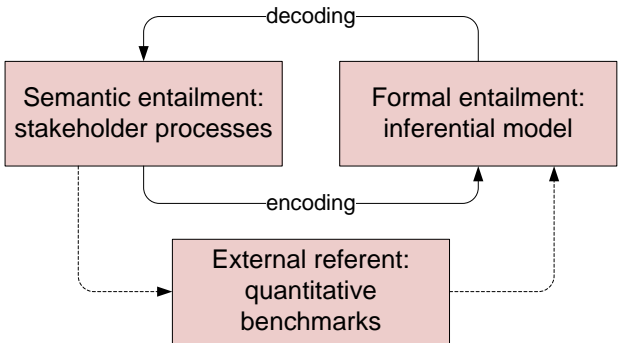


Figure 2. Interpretation of Rosen's Modelling Theory

Although there was detailed information on how to apply SUMMA, there was no information provided for using the tool with stakeholders within specific institutional contexts. The MUSIASSEM developers did not provide explicit guidance on the procedures for implementing the tool. Using Rosen's (1978) principles of modelling, we constructed a procedural diagram (Figure 2), that illustrates the need to close the loop between the outputs of the formal model and the perceptions of the system expressed by stakeholders. Whilst both tools advise carrying out this step, there is little explanation of how to do this stage compared to the detailed guidance on the formal modelling procedures.

Case study application

The Cairngorms National Park is the largest national park in the UK and was created as a result of the National Park (Scotland) Act in 2003. It covers approximately 3,800 km² and is home to approximately 16,000 human residents as well as significant protected habitats and species. National Parks in Scotland are explicitly required to achieve 'sustainable development', as illustrated by the four statutory duties set out in the Park Act: to conserve and enhance the natural and cultural heritage of the area; to promote sustainable use of the natural resources of the area; to promote understanding and enjoyment of the special qualities of the area by the public; and to promote sustainable economic and social development of the area's communities. Therefore, they are not 'wilderness reserves' but fit the IUCN category V (protected landscape). The Park has a statutory management authority – Cairngorms National Park Authority (CNPA) but unusually, the CNPA are not land owners, regulators or service providers per se, but instead seek to coordinate the multiple private, public and voluntary/NGO sector land owners at the local, regional and national (Scottish) level.

Methodology

The results are based on 4 phases of data collection and analyses: introducing the study (3 sets of field notes/transcripts from interviews and two letters); systems diagramming workshop (2 sets of field notes, one transcript); follow up discussions (5 sets of field notes/transcripts from interviews) and the utility workshop (2 sets of field notes, one transcript, 3 evaluation forms). The SMILE project works in parallel with a longitudinal research project funded by the Scottish Government from 2006 – 2011, which aims to collaboratively evaluate the development and implementation of the Cairngorms National Park Plan. The approach is focussed on ongoing social learning through collecting, analysing and sharing findings. The semi-structured interviews were held with individuals or groups of CNPA staff for the longitudinal research project. Where possible, the interviews were taped, providing a combination of field notes and verbatim transcript. These were loaded into NVIVO¹ for data management and analysis. The data coded to the node 'SMILE project', covering all comments about the project were then analysed by the first author.

The project was originally presented to the CNPA during a group interview in December 2007, followed up by correspondence in April and August 2008; and the project was then discussed at a group interview in August 2008. A system diagramming workshop was held in November 2008, involving five participants from the CNPA and four from the MLURI in a deliberative group process. The methodology is described in D16 (see <http://www.smile-fp7.eu/?id=deliverables>) and results in Blackstock et al., (2009). The SMILE project's progress was discussed in five interviews (2009-2010), involving two of the key informants who took part in the workshops. The utility workshop was held in December 2010, at the CNPA offices and involved three participants from the CNPA and two from MLURI. All the participants had between a little and a fair amount of knowledge about sustainability assessment. We do not claim generalisability from the evaluation metrics, given the size and purposive nature of the sample.

¹ A computer assisted qualitative data analysis software, we used NVIVO 8.

The utility workshop was a round table, interactive process; therefore the information was presented in workbooks, which were annotated by participants with ideas, questions and comments. The content balanced explanation of the methodology with a sufficient range of results to illustrate what the tools can do. The workbook had four sections. First, the project was (re)introduced and the aims of the workshop were presented. This took approximately 20 minutes, with little discussion. Then the SUMMA tool and results were presented. This section took about an hour and three quarters, and generated considerable discussion. The participants filled in the SUMMA evaluation sheet during the coffee break. The MUSIASSEM tool and results was presented, lasting about an hour and there was also much discussion. The final section on overall evaluation of the tools and the next steps for the project was a group based discussion. The participants then filled in the MUSIASSEM and overall evaluation form. The results are tentative as the application of SUMMA to wider land use and more detailed analyses using MuSIASEM are being finalised and running a workshop during unseasonably cold weather affected the number of participants. We will run a workshop in June 2011, with more participants and a wider set of results, leading to final conclusions.

3. Results

This section reports on all four sources of data, although it mostly focuses on the utility workshop. Participants felt the work book had provided new information on sustainability assessment. However, only one felt they had changed their views on sustainability assessment and neither changed their views on the sustainability of the CNP after the workshop.

Views on the SMILE project expressed prior to utility workshop

The SMILE project was promoted as an opportunity to “bring these models to the Cairngorms National Park Authority to see if they actually help you make some of your decisions” (Dec, 2007). We agreed to look at the economic profitability of the land use sector, its environmental impact particularly with relation to climate change and aspects of social justice. Further aspects of sustainable development were raised 2009 – 2010 - how SMILE tools could complement their baseline economic state of the park report and how the SMILE tools could relate economic and social well-being to the Park’s natural assets. However, it was also important to focus on the national perspective and legitimacy of decision making processes. The need to interest and engage the Scottish Government in the research was raised during both workshops. However, the difficulties in using tools with policy makers were also raised: “I’m very keen on this multivariate analysis, but policy is very.... uni-variate ... it usually focuses on one particular issue” (Nov, 2008).

The concerns for the CNPA were staff time commitment; availability of, and access to, data; and whether the CNP was a suitable case study. These comments highlighted that any tool has to be both practical and require relatively little staff time to be attractive. Furthermore, staff members noted that they had reservations over whether the results of the tool would be reliable as they thought it was unlikely that we could get sufficient data to make the tool work. At a feedback discussion in February 2009, CNPA staff members teased the MLURI team for being ‘far too enthusiastic’ as we were using two new tools for a new spatial domain for the first time whilst trying to apply the tools with stakeholders.

The language and terminology used by the SMILE project team has proved somewhat of a barrier - whenever the SMILE project and the tools were mentioned, there would always be a smile or joke about the complex terminology.

Specific feedback on SUMMA from utility workshop

Once the participants had been given an extended introduction to the tool itself, including the concept of energy and the indexes used, the following issues were discussed. The participants were ‘excited’ by some material, such as workbook page 22, which illustrated that the CNP has low emissions from the agricultural sector per hectare compared to Scotland’s agricultural sector’s average, but the situation is reversed when it comes to units of dry matter, energy and money. The participants offered and evaluated various explanations for why this might be so including the energy mix, high transport costs, fixed infrastructure costs, etc (see D23 for more information).

However, there were queries about the inputs to SUMMA and how these might affect the results as presented. For example, one participant queried the land cover figure used as they believe that IACS returning land parcels comprised 70-80% of the Park, not 47% as the workbook suggested¹. One participant was uncomfortable with the system diagram as it did not fit with how he conceptualises the system. The MLURI facilitator also noted that we are yet to calculate uncertainties for the data input; that fuel use doesn’t yet include solid fuel and that the methane results have not included the direct emissions from livestock, which may explain why one participant noted that “there are too many caveats and gaps in the input data to give me confidence that the outputs are a reliable basis on which to shape or monitor policy” (Dec, 2010).

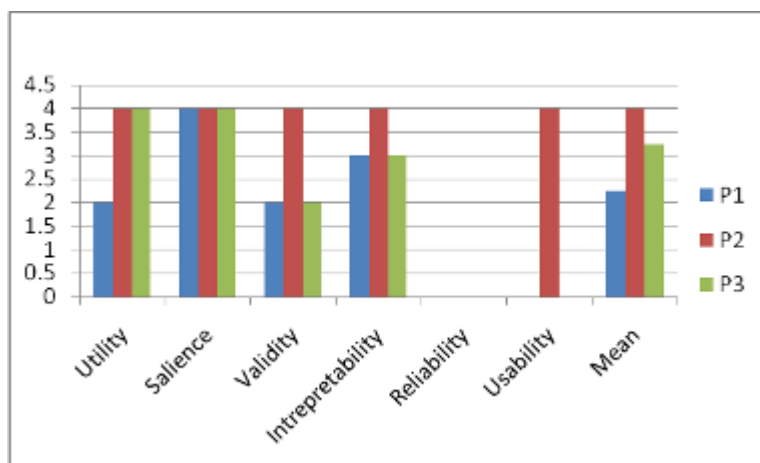


Figure 3. Evaluation results for SUMMA, December 2010

These queries about the quality of data inputs can also be related to the need to avoid averaging across the Park. For example, emissions from peat are an important issue in the CNP, but SUMMA uses emissions from an average agricultural soil. Participants also questioned the treating all grassland management the same, when the ‘agricultural’ area is highly heterogeneous and differentiated. Some

¹ 47% was the coverage in 2007 with ~75% in 2009. IACS stands for Integrated Administration and Control System that collates information on agricultural business holdings.

grazing results in meat production, but other areas are actively managed for field sports or nature conservation. As shown by the Figure, views on the overall utility of SUMMA varied. The lower scores for the utility of the tool and the validity of the tool are explained by the lack of confidence in the input data. None of the three participants thought they would try to run SUMMA themselves, which explains the missing data for reliability and usability.

Specific feedback from MUSIASSEM from utility workshop

As with SUMMA above, the participants were interested in the results, and immediately began to try to interpret and explain the trends. For example, the participants tried to guess why the CNP result (for ELP pw by EMR pw by region¹) was clustered with Edinburgh, Glasgow and Aberdeen City, Shire and Moray. The reasons given included the influence of distilleries and the number of wealthy people living in the Park. The participants felt the results might illustrate the average hours worked – the CNP has 12% of human activity in paid work compared to 9% for Scotland as a whole. The participants were intrigued that Gross Value Added (GVA) for the CNP seemed to be the same as the Scottish average but the average income for the CNP is below the national average (the latter statistic was provided by the participants). This led into a discussion about the ability to capture the social benefits of high yield industries in the Park.

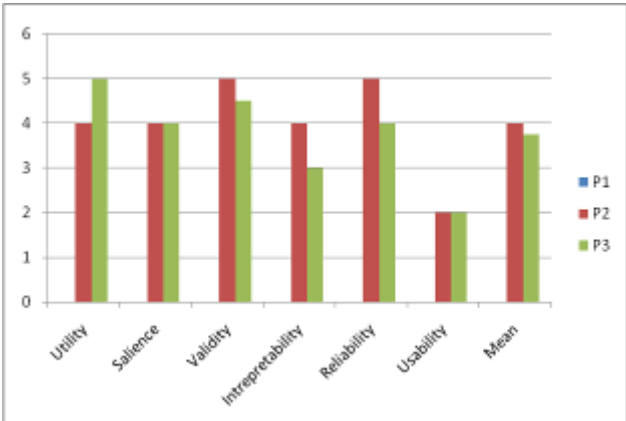


Figure 4. Evaluation results for MUSIASSEM, December 2010

The major issue regarding inputs to MUSIASSEM was whether GVA was the most appropriate metric. Participants were unsure if the GVA includes changes in house values, as this is likely to have increased the figures given the rise in values for the period. There was also a question about whether GVA included pensions and incomes earned elsewhere. Participants felt GVA may not be a good indicator of the flow of money within and between the park and Scotland or the best measure for a small region where people commute across its boundary. However, there was less discussion about the quality and appropriateness of the inputs, beyond the focus on GVA. This may be because there are fewer inputs to the tool, and those inputs are more generic, so are less contentious. As shown by the Figure 3²; views on the overall

¹ ELP = Economic Labour productivity (calculated by dividing Gross Value Added by Total Human Activity). EMR = Exo-somatic metabolic rate (calculated by dividing total energy throughput by Total human activity). PW = paid work sector. Scotland is divided into NUTS3 regions.

² P1 did not fill in an evaluation form for MUSIASSEM or the overall workshop due to leaving before the end.

utility of MUSIASSEM were less varied than for SUMMA. Again, the answers on validity were qualified with respect to the availability of data. One participant qualified their answer on interpretability by noting 'with guidance only'. Although participants wouldn't try to run MUSIASSEM themselves, they did score for on reliability and usability.

Overall views on utility of tools

Table 1 shows the results of the ranking for criteria when evaluating utility of SUMMA and MUSIASSEM. This demonstrates the diversity of preferences, but confirms the primacy of utility, salience and validity. A free choice for additional criteria was offered, but none were mentioned.

Table 1. Individual rankings for utility criteria

Ranking	P1 - SUMMA	P2 - SUMMA	P3 - SUMMA	P2 - MUSIASSEM	P3 - MUSIASSEM
1	Utility Salience	Utility Salience Interpretability	Validity	Utility Salience Interpretability Reliability Usability	Validity
2	Validity	Validity Reliability Usability	Utility	Validity	Salience
3	Interpretability		Salience		Usability
4	Usability		Reliability		Utility
5	Reliability		Interpretability		Interpretability
6			Usability		Reliability

The workshop discussions, combined with the evaluation results, suggest that MuSIASEM was seen as a more useful tool than SUMMA. When asked to compare the utility of the tools, the participants felt that the SUMMA application at Park level was inappropriate. The national scale did not illustrate the important regional differences in Scottish agriculture; and the Park level also overlooked important differences in agricultural systems between areas. They felt the 'blanket' coverage of MuSIASEM was more relevant and more attractive. SUMMA was perceived to be less transparent, although it raises some useful questions and the presentation of both the trend and the degree of the results was appreciated. Participants wanted to understand more about the 'black box'; as they noted that if they can't explain how the results are produced, then they are wary of using them in their work "it's hard to defend a trend if you can't understand how it is was generated". SUMMA was perceived to be data hungry, and the participants talked about the need to trade off the cost of accessing and preparing the data to the benefit gained from the information. One pointed out that it is not just the one off cost of accessing the data but "if the analysis can't be replicated, then it loses its value". Another participant then wanted to know what would happen to the tools when the project ended, "would they just sit on a

shelf?¹ This is important given the evaluation returns that suggest that none of the participants intend to use the tools themselves.

The participants feel the results were salient to the Scottish Land Use Strategy, the CNPA's landscape strategy and the Low Carbon Cairngorms project. During this discussion, the notion of decision-making scale was reintroduced. One participant pointed out that many of the questions raised by the tools are not able to be solved by the CNPA. For example, the Park provides an administrative boundary but agricultural decisions are made at Scottish Government or the farm level. Therefore, it will be easier to interest CNP-level stakeholders if Scottish Government uses these tools to make policy decisions. The CNPA participants were willing to "make an investment" to try to understand the material, due to their personal interest and their role at work. However, they did not think other stakeholders, with less interest in research, would be willing to invest the time required to understand the tools. Furthermore, one felt there is 'no natural constituency' and whilst stakeholders might be interested in some results, but few would be interested in all of them.

4. Concluding Discussion

As the tools are unlikely to be used by anyone other than researchers, this discussion focuses on validation, salience and interpretability. The lead author expected that the participants would score the validity of SUMMA lower than MuSIASEM because the SUMMA tool appears to have more complex inputs, co-efficients and outputs, which would be more sensitive to uncertainty. She expected the participants to rate the interpretability, reliability and usability of MuSIASEM lower. Validity was closely linked with whether the participants felt the outputs from the SUMMA tool were credible and reflected their perspectives of the system, reflecting the literature. The more interesting question therefore is why the validity of MuSIASEM was not raised, given the complexity and value-laden issues of economic and social performance, although if the socio-economists had attended, they may have been more questioning.

The salience of both the tools was ranked relatively high. This partly reflects the fact that we had tried to focus on issues with policy traction. However, the results resonate with McNie's comments about feedback loops, whereby there are path-dependencies between the Research and Development phases, which may not suit the needs for the Operational phase. Policy priorities are dynamic and shift more quickly than the pace of tool development and application. We were broadly correct in our requirements analysis but our ability to service the changing policy requirements was limited. The issues of interpretability relate to the ability to use the results, not the tools themselves. Our findings show that there was a problem with terminology, a diversity of ability to interpret the outputs, and preferences for the different presentations. Outputs from both tools needed to be explained before they could be interpreted. One participant noted he has discussed the SMILE outputs a number of times but it took until Dec 2010 for him to start to understand the implications.

¹ The social metabolism approach is written into the next five year Scottish Government funding programme, so the capacity will be maintained by the authors.

Our findings illustrate that relationships and social capital are important at the Development phase. Our participants may have been frank with us when talking about the drawbacks of the tools given we were not the tool developers. We have worked with these participants for the past five years – as they have found previous analysis to be useful and to be credible, we have some reputational capital on which to draw. Data from the longitudinal research project also suggest that these participants are willing to use outputs from other modelling projects, when they find the results credible, and they have a history of working with those modellers.

Finally, reflecting on Sterk et al.'s typology of tool use, our findings suggest that the participants are unconvinced about SUMMA's role as a heuristic or using either tool as a boundary object, due to problems with interpretability. They are unwilling to place much faith in the trends that SUMMA produces, until the inputs are contextualised for the different land use subsystems within the Park. However, the fact that they were comfortable with the 'blanket' approach of MUSIASSEM and the flow/fund ratios may suggest that this tool could play a heuristic (or early warning) role. Therefore, the tools are most useful as symbolic objects, to communicate key trends to policy makers. The issues of interpretability are important; given the findings suggest that it would be difficult to present these complex ideas to the Scottish Government, who want 'uni-variate answers'. The findings resonate with the difficulties of engaging policy makers with long term, complex and intractable problems requiring adaptive management (Verweij and Thompson, 2006). However, it is these conditions when (a) more meaningful sustainability assessments and (b) when social learning processes of knowledge exchange are needed.

The SMILE tools are extremely powerful at illuminating the parameters of the existing system and the trade-offs that have to be considered when pursuing normative goals of sustainable development. Our results illustrate the importance of having a shared semantic understanding before implementing formal representations of a system using tools and how to 'decode' the model outputs with the stakeholders. These steps are essential if the tools are to be seen as credible, salient and legitimate (Matthews et al. 2008). However, in addition, the utility of the tools will be affected by the practical issues of access to data and staff time, making the CNPA dependent on an intermediary between the tool developers and themselves.

Mainstreaming these tools requires us to move beyond working with the CNPA to those who might use the tool outputs to alter real world outcomes, but the participants' questioned who the "natural constituency" for these tools are. This illustrates the difficulty with sustainability assessments, when sustainability is relevant to everyone, yet few stakeholders are explicitly responsible for 'sustainability'. For the CNPA to enact sustainability, they must maintain the good will and support of Scottish Government and local landowners and communities (Dinnie et al., in press). Therefore, when using tools and their outputs, the CNPA staff must consider how the tool use will impact on their relationships with others, their personal and organisation reputations and their credibility in order to protect their claims to legitimacy. Our bonds of reciprocity with the CNPA are weak when set against their day-to-day relationships and the current political climate, where budget cuts are forcing all staff to prioritise and demonstrate delivery of Scottish Government policy. Within this context, salience of tools remains vital, but must be complemented by the ability to provide timely and credible evidence that sure up the legitimacy of the policy maker using them.

Acknowledgments

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MULTI-SCALE INTEGRATED ANALYSIS FOR SUSTAINABLE POLICIES: ROMANIAN SOCIOECONOMIC METABOLISM

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ABSTRACT – *Multi-Scale Integrated Analysis of Societal and Ecological Metabolism (MuSIASEM) is a method developed in relation to the field of science for governance and it can be used to check the robustness and the relevance of models, datasets, and forecasting using integrated biophysical, economic, social and demographic analyses across different hierarchical levels and scales. This paper shows for a specific case how structural changes in various economic sectors, associated to the transition from a centrally planned economy to a free market with European Union membership, can be related to socioeconomic metabolic variations. The Romanian exosomatic metabolism is discussed over a period of seven years (1999-2006) for sectors/industries on disaggregated hierarchical levels; the focus is on the analysis of industry-level data presented in correlation with microeconomic changes. We consider the following subsectors for the productive sector: mining and energy and manufacture and building; in support of our idea of structural change connected socioeconomic metabolism changes, the paper provides microeconomic details for some industries in the manufacture sector.*

Keywords: MuSIASEM, Romania, societal metabolism, energy, manufacture

1. Introduction

Romania is a country which switched in December 1989 from a command system to a free-market system and joined the European Union on January 1st 2007. Post-Revolutionary Romania had to undergo a “quintuple transition: building from scratch political, civil and economic societies; developing an autonomous, yet accountable, state bureaucracy and all the while constraining these aforementioned areas through the development of the rule of law and an independent judicial system to enforce the equal rights of Romania’s citizenry” [Turnock 2009, p.9]. Even in 2000, the Romanian institutional system was still not restructured and it was highly bureaucratic and inefficient in impossibility to support the free-market transition. To make things worse, besides populist political interests, labor unions have not been a responsible partner for the government when a severe reform program was needed (including e.g. the closing the underground mines, the liberalization of energy price, and breaking the state monopolies). Privatization was delayed until 1996 or it targeted only populist aspects and the consequence was that “the administrations before 1996 saddled the business people with two difficult burdens they had to cope on the long term... the deep hostility of the population, generated by the objective fact that a lot of fortunes had been accumulated in a quasi-illegal manner. The latter is the false impression of the private entrepreneurs themselves that their business could always be conducted under the umbrella of the State...” [Serbanescu 2007, p.52-53].

The communist industrial model, promoting the energy-intensive industrial sector with a use of energy per unit of output much higher than in Western countries, was already declining in 1989, leaving post-Revolution Romania with an inherited enormous economic gap between demand and offer [Serbanescu 2007, p. 31]. For eleven years, Romania did not have a clear strategy for development; only in 2000 it was demanded for European Union integration and in this context, Romania was required to reduce national energy consumption and increase energy efficiency at the end-use.

Nicholas Georgescu-Roegen [1971] emphasized the irreversibility of the economic process and the effect of the entropy law governing physical and biological processes and introduced the flow-fund model promoting the concepts of societal metabolism and bioeconomics. Multi-Scale Integrated Analysis of Societal and Ecological Metabolism (MuSIASEM) is a method developed [Giampietro and Mayumi 2000a, Giampietro and Mayumi 2000b, Giampietro 2003, Giampietro, Mayumi and Ramos-Martin 2009] in relation to the new field of science for governance and it can be used to check the robustness and the relevance of models, datasets, and forecasting using integrated biophysical, economic, social and demographic analyses across different hierarchical levels and scales. This paper applies the MuSIASEM approach to the study of structural changes in Romanian economy between 1999 and 2006 in country’s move towards the European Union member status and it has the purpose to build the Romanian database and the set of MuSIASEM intensive and extensive indicators down to level $n-4$.

Iorgulescu and Polimeni [2009] present the MuSIASEM approach to analyze Romanian socioeconomic system as a whole (level n) and disaggregated on two successive hierarchical levels ($n-1$ and $n-2$); the comparison is made with other European countries. The split between paid work compartment and households compartment represents level $n-1$, while the split of the paid work compartment in three main sectors (agriculture AG, productive sector PS, and commercial and public services SG) represents level $n-2$.

This study considers the Romanian exosomatic metabolism for some of the lower level sectors of the paid work compartment (levels $n-3$ and $n-4$). For level $n-3$, we consider groups of industries, mining and energy, manufacture and building, and transport; subsequently, for level $n-4$, manufacture and building sector is split into individual industries. Details regarding the microeconomic evolution are provided for some industries sorted by the intensity of their exosomatic metabolism.

The study is organized as follows: section 2 presents, using graphs, level $n-3$ and $n-4$ results for MuSIASEM exosomatic metabolic rate; section 3 presents data processing details for the three types of data: energy, hours of work in each paid-work activity, and gross domestic product (very important details when the economy is disaggregated down to level $n-4$); finally, section 4 concludes.

2. Energy metabolism Intensity Results for levels $n-3$ and $n-4$

The evolution of the energy metabolism intensity (exosomatic metabolic rate) for different groups of industries (level $n-3$) and industries (level $n-4$) are discussed. For level $n-3$ (Figure 1) we consider the following subsectors for the productive sector: mining and energy (MiE) and manufacture and building (MaB). Similarly for the services and government sector we consider as subsectors: transport, public administration and other sectors. Each of these subsectors (except for public administration and other sectors) can be split further at level $n-4$ (Figures 2 to 5). Structural changes in each economic sector can be related to metabolic variations and this section will provide microeconomic details for certain industries to support this statement.

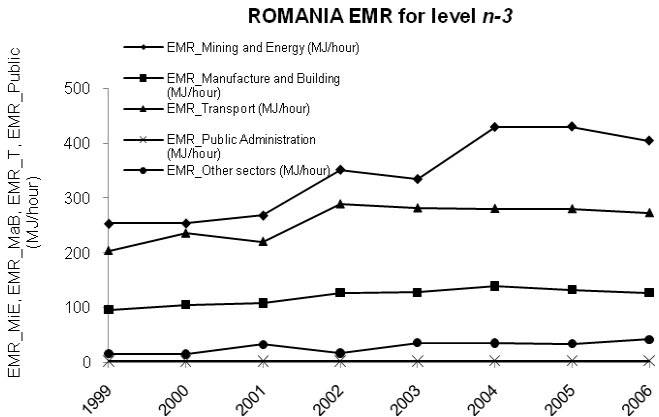


Figure 1.

Figure 2 depicts the EMR for the **Manufacture and Building** sector split first between the **Manufacture** sub-sector and **Building** industry. It is noticeable the similar pattern between 1999 and 2002 and the opposite behavior of energy metabolism afterwards; this behavior requires the discussion of level $n-4$ manufacture industries.

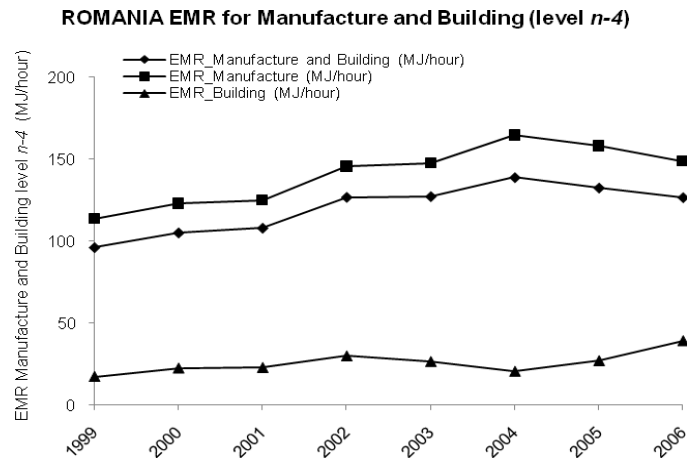


Figure 2.

The *Manufacture* sector has twenty one industries that can be split into three groups, depending on the intensity of their energy metabolism. Five industries have a high energy metabolism, with EMR higher than 200MJ/hour (Figure 3); eight industries have a medium energy metabolism, with EMR lower than 200 MJ/hour but higher than 60 MJ/hour (Figure 4); and finally, eight more industries have a low energy metabolism, with an EMR lower than 60MJ/hour at any moment (Figure 5).

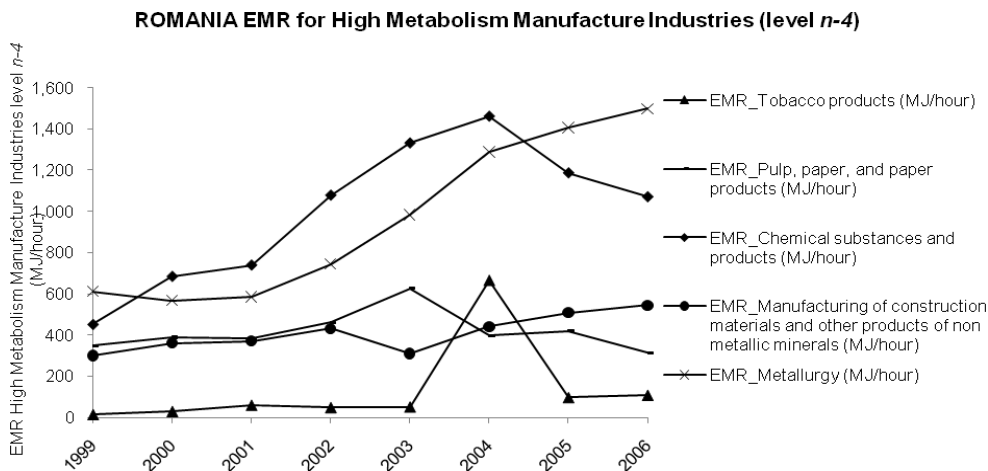


Figure 3.

Details regarding changes in specific industries with a high energy metabolism will be provided for Metallurgy and Pulp, paper and paper products industries; both have a high rate of energy consumption per hour of human activity invested.

The intensity of Metallurgy's energy metabolism decreased until 2001 and after that it increased steadily (due to personnel reduction and increased production). The major component of Romania's metallurgical industry is steel production. Between 1997 and 1999 the whole industry was almost bankrupt. The seven plants (Resita, Hunedoara, Calan, Otelul Rosu, Galati and Calarasi) had annual losses hundreds of millions Euros. Until 2000-2001, productive capacity was drastically reduced and

subsequently the plants were privatized. For example, SIDEX Galati was privatized in 2001-2002 and subsequently it increased production three times and greatly reduced the number of workers.

The Pulp, paper, and paper products industry had a decrease of the rate of exosomatic metabolism after 2003. On a micro level this behaviour is explained by the bankruptcy state of most of the firms except for a few viable firms.

Figures 4 and 5 present the evolution of the medium and low energy metabolism manufacture industries and some of this changes can be related to changes in households' lifestyle and the increased use of imported goods.

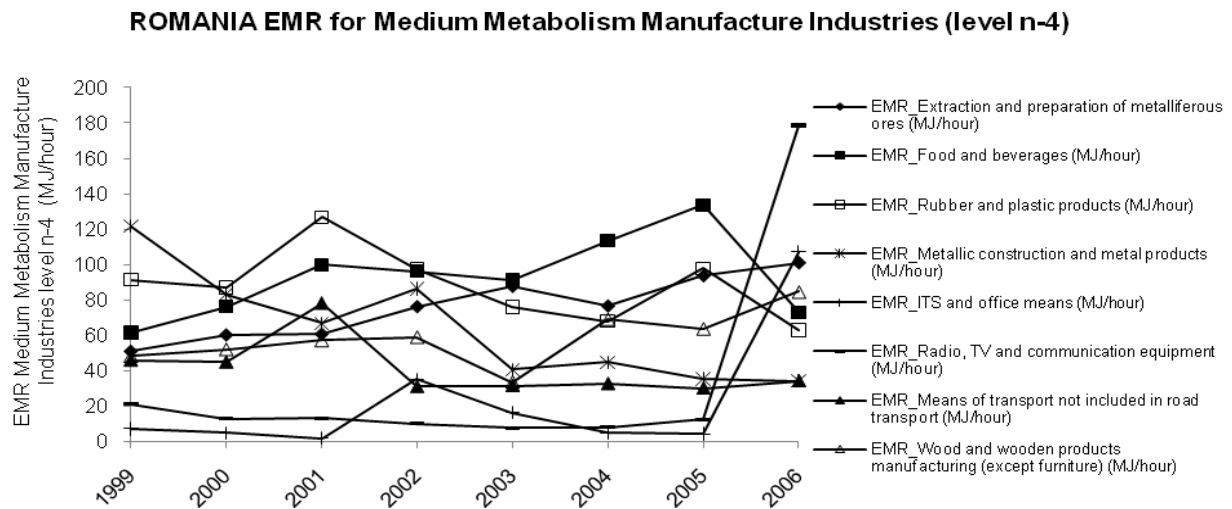


Figure 4.

In the case of Means of transport not included in road transport, we notice almost no changes in the energy metabolism between 2002 and 2005. This industry includes aircraft factories which had no acceptable privatization offers and with no substantial employment increase [Turnock 2009] and implicitly no major improvement of the technology used.

According to Turnock [2009, p. 187] in Romania, the Food and beverages industry is a traditional sector for which

“stimulated by increasing purchasing power since 2000, growth has been crucially important in the run-up to EU accession and the removal of all protective barriers, with the added value of rising meat and milk sales to maintain the recovery of livestock farming... Consolidation is awaited with many more mergers and acquisitions previously discouraged by uncertainties over raw material supplies and agricultural policies.”

In 2003, the Romanian government and the UN Industrial Development Organization launched a joint project to support SMEs in the food industry for quality improvements, diversification and exporting for beef, dairy products, and processed food and vegetable. This can be associated with the steady increase in the energy metabolism of this industry between 2003 and 2005.

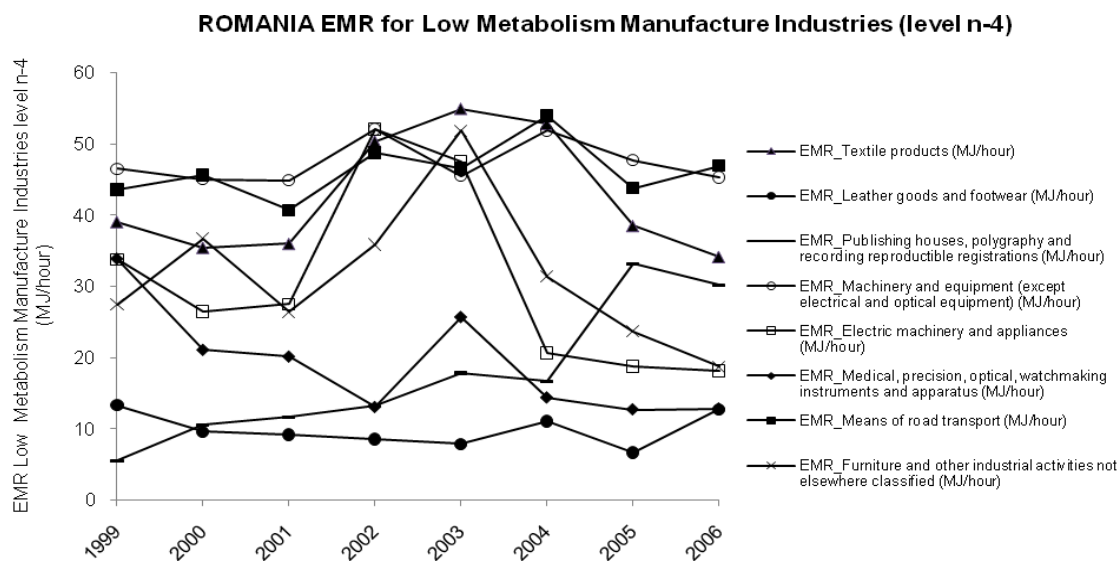


Figure 5.

Between 2002 and 2006, Electric machinery and appliances industry had a drastically decreasing exosomatic metabolic rate; this behavior of the whole industry is related to the increase in imports (reduced demand) and to western businesses opening new plants in Romania or taking over previously Romanian-owned firms (improvement in technology).

3. Data Collection

ENERGY

Data source

Statistical data are presented within the *final energy system*. The data source consists of the annual statistical surveys of the production of electricity and thermal energy, energy resources and their use, resources and consumption of electricity, thermal energy, fuels, motor fuels and lubricants.

Besides them, specialized annual statistical surveys, with pre-established destination, are used:

- Production of electricity and thermal energy in nuclear power stations
- Crude oil processing balance sheet.

The nomenclature on which reporting is based consists of 13400 units (firms): for the industry producing electricity and thermal energy, industrial consumers with over 250 employees and consumers from transports, construction and services with over 50 employees, while for the remaining units a representative sample is taken over.

Data on international trade in goods

This data is obtained as follows: for the extra-community trade from the National Customs Authority (NCA), which carries out export and import custom statements collection and processing; for those

referring to intra-community trade, through Intrastat statistical statements collected by the National Institute of Statistics (NIS) from economic agents which have achieved intra-community exchanges (in accordance with Law no. 422/2007) and based on customs statements related to intra-community trade exchanges supplied by NCA.

Population energy consumption

For households, the information was completed with data obtained from Household Budgets Survey, thus being included the quantities of fuels obtained from own activities of population households.

- In this study, fuel consumption in households' private transport means is included under Households consumption (ETHH).
- The statistical data series for all energy indicators refer to the period 1993 - 2007.
- The conventional unit is tonne of coal equivalent, defined by convention as a fuel of 29307 KJ/Kg (7000 Kcal/Kg) net calorific value.
- The indicator Energy consumption in transports – road transport was separated in Population energy consumption and Energy consumption of other economic agents
- For the period 1999–2007 the data series are available at the most disaggregated level, while for the period 1993–1998 some aggregated activity branches are available, whose components have been estimated based on the structure of each aggregated activity branch.

HUMAN ACTIVITY

The data used in the present study for *hours actually worked* in the production sector and services and government are based on the *Survey on the labour cost (S3)* which collects the information provided by firms about their employees; for agriculture we used the data provided by the *survey of households AMIGO* (since in Romanian agriculture there are very few firms and using the information from firms survey would distort the results).

GROSS DOMESTIC PRODUCT AND TAXES

The computation of GDP for industry 'i' (levels lower than $n-2$):

$$\text{GDP}_i = \text{Value-added}_i + \text{Net Taxes}_i \quad (1)$$

$$\text{Net Taxes}_i = \text{Tax revenue}_i - \text{Subsidies}_i \quad (2)$$

Data source

- The statistical series of gross value added components by activity branches are taken over from the Input – Output Table compiled according to the National Accounts methodology. These data are supplied by the National Institute of Statistics for each year, both in current prices and in comparable prices of previous year.

- The database of net taxes on products was built up based on the same structure by activity branches, both in current prices and in comparable prices of previous year. The information from the Input – Output Table has been used.
- The data from the Input – Output Table are available until 2006, inclusively, in accordance with Eurostat requirements; for 2007 no further detailed computations could be done due to the lack of statistical information.

Statistical processing

- Statistical processing refers to the computation in constant prices of the year 2000 of statistical series by activity branches related to gross value added and to net taxes on products.
- During the first stage, chain volume indices were compiled for each year as compared to previous year by using the data series in comparable prices of previous year and the data series in current prices
- During the second stage, the volume indices were compiled for each year as compared to the year 2000 considered as 100%. The data series in constant prices of the year 2000 were recompiled by multiplying these indices with the values expressed in current prices of the year 2000.
- The following three industrial branches were compiled by summing up the components:
 - Mining and quarrying industry
 - Manufacturing
 - Electricity and thermal energy, gas and water
- The three aggregated series were compiled in constant prices of the year 2000: total industry, gross value added and net taxes, while the gross domestic product was compiled by summing up the latter two series.
- The series Other services was compiled by subtracting the other components from the gross value added, otherwise this series being biased due to statistical discrepancies, but the error is below 1%.

4. Future Work: MuSIASEM Variables and Energy Intensity at Sector Level

International organizations and national agencies use energy intensity as an indicator for energy efficiency of a country and transitional countries which joined or intend to join the EU are required to adjust their energy sector in order to reduce their energy intensity to levels comparable to those of the full members. Once the issue of data sources for energy consumption, hours actually worked, and gross domestic product generated at various hierarchical levels is discussed and solved (see Iorgulescu et al. in Proceedings to 7th Biennial International Workshop ‘Advances in Energy Studies 2010’) we suggest to proceed with an analysis of energy intensity for different sectors expressed as a combination of three MuSIASEM variables:

$$\text{EnergyIntensity } i = \frac{ET_i}{GDP_i} = EMR_i \times \frac{1}{SIHA_i} \times \frac{1}{ELP_i} \quad (1)$$

where

ET_i → exosomatic throughput;

GDP_i → gross domestic product in sector i ;

EMR_i → exosomatic metabolic rate for sector i is final energy consumed in that sector per hour of human activity;

$SIHA_i$ → saturation index for human activity in sector i is the percentage of human activity used for activities in sector i ;

ELP_i → exosomatic labor productivity in the paid work compartment is GDP_i produced per hour of human activity in sector i .

This alternative approach would explain the source of differences in energy intensities in different sectors and guide the policymakers in elaborating their structural change strategies.

Acknowledgements

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TRENDS OF FINNISH MFA AND FUTURE PROSPECTS

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1. Introduction

The economy-wide MFA provides systematic overview to a national economy by tracking all physical interactions between environment and economy by accounting all the human-caused physical input and output flows of an economic system. Economy-wide MFA systematically describe and monitor the industrial metabolism of national economies in a consistent manner. MFA also complements the System of National Accounts (SNA). The basic premise of MFA-based analysis is that the amount of resource flow inputs into the economy determines the amount of all outputs to the environment, including wastes and emissions. Thus, a reduction in resource inputs will reduce the outputs including emissions and waste. This lowers pressure on the environment.

Beside useful commodities, economic activities create residuals (pollution and waste) that are usually harmful to human beings and to the nature. After the useful days of commodities are over, they are discarded to nature (waste and pollution). As time lapse all produced commodities end up to nature as waste and pollution. Thus ecological impacts of human activities can be expressed by material flows that comprise, among other things, energy carriers, minerals, fuels, sand and gravel, soil, water, air and overburdening. In principle, all masses moved by technical means cause some environmental impacts and they should be taken into account. The first law of thermodynamics, i.e. the principle that the amount of material and energy remains constant at any flow or process in a system, says that the input and output of a process must be equal. To the extent that environmental impacts are the consequence of the magnitude of total material input into production in an economy, they can be lessened by reducing the intensity of materials use.

MFA is a means by which the stocks and appropriate flows of natural resources can be combined into a single overall picture describing their interaction (see figure 1). Thus the economy takes in raw materials - from the domestic environment and via imports from foreign countries - for further processing, manufacturing, production and consumption. Some materials, such as construction minerals, are stored in buildings and infrastructures for many years. At the end of their useful life, products become waste and may be recycled or finally disposed of in landfills or incineration plants. Hence, the size of the resource input also determines the amounts of subsequent waste and emissions. However there are differences between material flows according to whether they emerge and can be seen as direct flows e.g. wood resources or iron ore taken into production or wastes of economy or as hidden

flows such as the residuals of production i.e. flows that emerges when extracting virgin materials but which does not enter the economy.

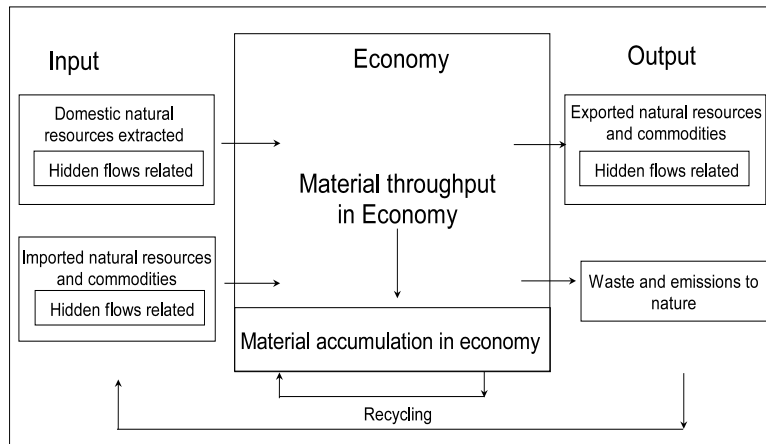


Figure 1. Economy-wide MFA calculation framework (Source: Eurostat 2001, modified)

The purpose of FIN-NFA is to produce economy-wide material flow accounts with hidden flows. Thus it focuses on quantifying domestic natural resources extracted, imported natural resources and commodities, exported natural resources and commodities as well as on related hidden flows.

2. The FIN-MFA accounting system

The Finnish Material Flow Accounts with Hidden Flows (FIN-MFA) system is based on excel sheets. This workbook in it's self contains methodological and practical working methods as well as the multipliers for hidden flow calculations needed to compile reliable Material Flow Accounts (MFA) including direct material inputs as well as corresponding hidden material flows for national economy of Finland. The general structure of FIN-MFA accounting system is presented in table 1.

Table 1. General structure of FIN-MFA accounting system

Domestic Flows (Direct and hidden flows)
Metals and minerals
Forest and forest by-products
Agriculture
Earth Materials
Other non-renewables
Other renewables
Exported Flows (Direct and hidden flows)
Imported Flows (Direct and hidden flows)
Metals and minerals
Forest and forest by-products
Agriculture
Earth Materials
Other non-renewables
Other renewables
Main Aggregates
Direct Material Input (DMI)
Direct Material Consumption (DMC)
Total Hidden Flows (THF)
Total Material Requirement (TMR)
Total Material Consumption (TMC)

In FIN-MFA accounting system domestic flow accounts are divided by sectors and they contain both the direct as well as hidden flows. Domestic hidden flows are either compiled from existing statistics (e.g. mining) or produced by using relevant multipliers (earth materials, forest and forest by-products, agriculture). By volume these domestic flows are by the far the most important part of FIN-MFA. The most work however, has been done in collecting material flows of external trade. As Finland is typically depended on large-scale external trade, especially on exporting natural resource intensive commodities, are these accounts important part of FIN-MFA workbook. Imported and exported hidden flows are solely produced by using relevant multipliers. In FIN-MFA accounting system the economy-wide MFA main aggregates are calculated automatically by using the above mentioned different material flows. These indicators describe different environmental impacts and they are needed in the subsequent MFA analysis and for policy making.

3. Economy-wide MFA aggregate indicators

MFA aggregate indicators can be used as proxies of environmental effects of economic activities or human-caused environmental burden. However, material flow indicators do not directly tell about the actual environmental impacts that are caused to earth. As MFA-approach does not classify the harmfulness of specific material flows, they can not the scope of the wide variety of environmental effects caused by different material flows. Thus, small material flows that have large environmental effects can easily be neglected in these weight-based indicators. The focus on reduction of aggregated resource use is thus necessary, but not sufficient, precondition for achieving environmental sustainability. (Giljum et al. 2006.)

Economy-wide MFA indicators indicate the overall the metabolic performance of national economies they sum all materials required by an economy in metric tonnes. They developments of certain important trends related to economic activities and the environment. Direct Material Input (DMI), which is the aggregated measure of the natural resource commodities that enter an industrial economy for further processing. The DMI includes all materials used for production; the natural resources needed for energy production, auxiliary material production, infrastructures, transportation, factories, etc., in a product line. From environmental policy point of view DMI represents the proxy of potential environmental pressures caused the welfare creation processes of a society. Direct Material Consumption (DMC) accounts for all materials used up by a country. Thus, in calculation of DMC exports subtracted from DMI indicator. DMC is most comparable MFA indicator to GDP. From environmental perspective DMC can be regarded as a proxy of potential environmental pressures associated to the disposal of residual materials to the domestic environment.

Total Material Requirement (TMR) counts all material inputs required by a national economy. Beside direct flows TMR also includes the hidden or indirect material flows (or ecological rucksacks of direct flows). These hidden flows (HF) are material flows or relocations of materials which are caused by the utilisation of Direct Material Inputs but which never enter the economy. (Hinterberger et al 1997, 10; Adriaanse et al. 1997, 7-8). Thus TMR measures the total use of natural resources that a national economic activity requires. From economic perspective TMR is a measure of the physical basis of the economy, or the total primary resource requirements of all production activities of a national economy. TMR is a proxy for potential environmental pressures caused by resource extractions. Total Material

Consumption (TMC) is a derivative of TMR. TMC equals TMR minus exports and their hidden flows. Thus TMC is a proxy of all potential environmental pressures associated to the disposal of residual materials to the domestic environment.

4. Ecological rucksacks and hidden flow multipliers

One new recent development of MFA is the attention drawn to hidden flows, i.e. those material flows which arise when natural resources are exploited but which do not enter the sphere of economic activity. This point of view is based on the MIPS (Material Input Per Service) concept, developed by Friedrich Schmidt-Bleek (1994), which uses the amount of material invested in a given service over its entire life cycle as a gross indicator of its potential environmental impact. Even though the MIPS was originally intended for evaluating individual products and services, it may also be applied to whole economies and to geographical areas. The principal concept of the MIPS is that of the "ecological rucksack" of a product or material, which also includes the material flows involved in its manufacture and use but which do not form part of the product or material itself.

In Europe the Wuppertal Institute has been compiling country specific data to determine the coefficients of hidden flows. The work on determining these multipliers as they vary a lot depending on the originate location is very labourite and time-consuming. At the current stage the dynamics the coefficients is very slow and the major challenge is to establish a database of dynamic multipliers which vary in time. To determine coefficient the concept of Material Input (MI) which constitutes in two parts the weight of the product itself and the ecological rucksack related and is also the basis to calculate MIPS (Material Input per Service) can be used to determine some of the multipliers. Further the Material Intensity which is important concept of the MIPS calculation can be measured on the basis of MI. Material Intensity by definition is the relation between MI (sum of the used resources) and weight unit (Ritthoff, Rohn & Liedthe 2002, 12). Material Intensities can be determined tonnes per ton produced but also e.g. tonnes per MWh for energy carriers. To determine some of the hidden flow multipliers of imported products we have used some of the material intensities determined by Wuppertal Institute.

5. Domestic flows in Finland

There exist three indicators for describing the quantity of material flows in the domestic economy. These indicators are Direct Material Input (DMI), Domestic Material Consumption (DMC) and Domestic Processed Output (DPO). DMI includes all natural resources used directly in an economy, DMC describes the amount of domestic and imported material used in economy and DPO is the sum of domestic extraction and imports. Direct and hidden domestic material flows in Finland from 1945 to 2007 are presented in figure 2.

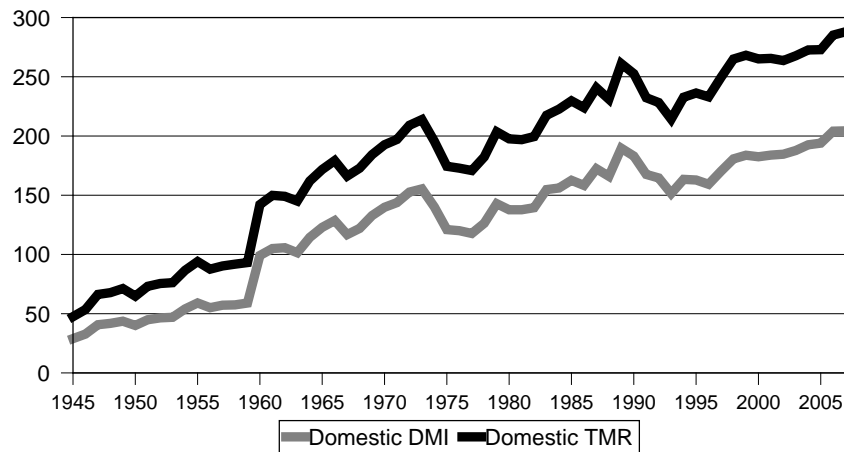


Figure 2. Direct and hidden domestic material flows in Finland from 1945 to 2007 (Million tonnes)

As can be seen from figure 2 the Finnish domestic DMI increased from 29.4 million tonnes in 1945 to 204.4 million tonnes in 2007. At the same period the Finnish domestic TMR increased from 47.5 million tonnes to 179 million tonnes. Most increases in materials consumption have occurred during 1960's, 1980's and 2000's. The trends of both indicators have been constantly growing with notable reductions in 1970's (due to first oil crisis) and 1990's (last economic recession). In general trends there is no evidence nor indication of dematerialization or immaterialisation processes.

Total domestic hidden flows in the year 2007 amounted up to 83.6 million tonnes i.e. 40.9 per cent of the amount of direct flows. The magnitude of hidden flows in earth materials, agriculture and forest sectors are directly related to magnitude of direct flows as in these sectors as hidden flow multipliers have been used to calculate them. Thus the improvements in technology efficiency or in the quality of direct flows have no effects on the quantities of hidden flows. The mining sector is the only sector where actual hidden flow statistics are compiled and thus this is the only sector where the hidden flows are not bound to direct flows. In the forest and agriculture sectors the approximations and use of multipliers are the only possible methods to assess the magnitude of relevant hidden flows.

The biggest domestic flows are wood material (43.4 per cent), earth materials (24.3 per cent), mining (15.8 per cent) and agriculture (13 per cent) and. The hidden flows of peat are quite modest share of the total (3.4 per cent). It seems likely that the hidden flow trends are set to continue in the 21st century. The increase in the material flows depends on the economical situation and the magnitude of the depression we are facing in the beginning of the year 2008. The previous depression in Finland can be detected from the MFA accounts as well. In the beginning of 1990 Finland was in economic regression due to financial crisis in the late 1980s. Economical situation begun to improve approximately by the mid 90's. The first oil crisis in the mid 70's and subsequent economic regression can also be seen in the use of materials. Thus as in near future the economical regression can have an effect on the material flows by decreasing it approximately somewhat 10 million tonnes. The influences of two economic regressions can be best detected from the use of earth materials which implicates that construction sector have suffered most severely or at least for longest compared to other sectors.

6. Imported and Exported Material Flows

By volume, the biggest imported materials are fossil fuels. Second substantial imported material flow are ore, metals and minerals. The hidden flows connected to imported material flows are mostly produced by multipliers obtained from various of sources. The multipliers give a rough estimate about how much hidden flows are connected to a specific imported material flow quantity. One of the biggest challenge for multipliers is that there are differences between countries as stated before and therefore the multipliers must be country specific e.g. in energy production the use of natural resources depends on the energy policy of the whole country, if the energy is produced with coal or nuclear power there are very different effects and demand of natural resources. Thus the multipliers of imported raw materials and commodities are not so transparent and thus international co-operation to determine the multipliers is needed. Direct and total imported material (including direct and hidden flows) flows to Finland from 1945 to 2007 are presented in figure 3.

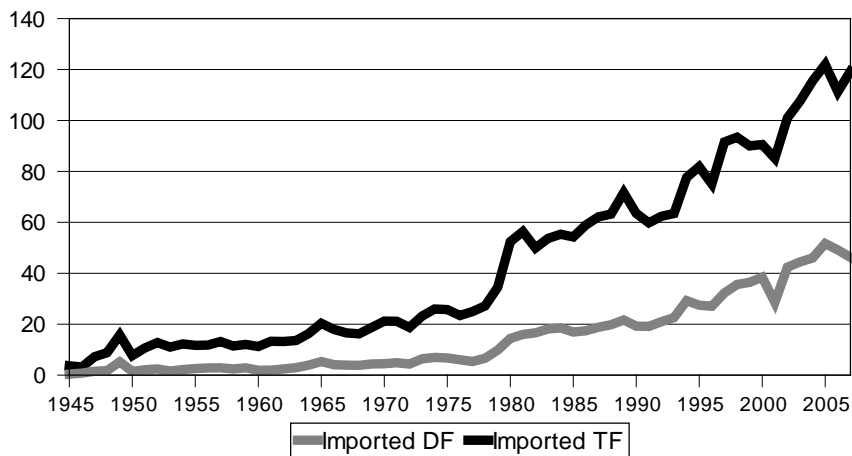


Figure 3. Imported direct and hidden material flows in Finland from 1945 to 2007 (Million tonnes)

As can be seen from figure 3 the imported direct material flow increased from 4.4 million tonnes in 1980 to 46.3 million tonnes in 2007. At the same period the imported total material flow increased from 18.7 million tonnes to 119.3 million tonnes. Most increases in these flows have occurred during 1980's, 1990's and 2000's. The trends of both indicators are also constantly growing. Figure 4 present the corresponding exported flows.

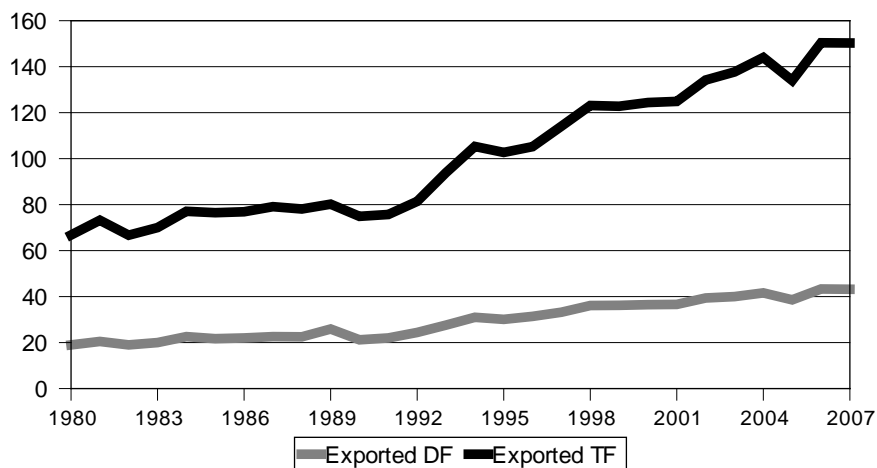


Figure 4. Exported direct and hidden material flows in Finland from 1945 to 2007 (Million tonnes)

As can be seen from figure 4 the exported material flows have increased in period from 1980 to 2007. However, as the direct flows have doubled, have the related hidden flows grown even far faster. In this period they have grown almost 2.5 -fold. Thus the structure of Finnish exports have changed and includes now more hidden flows than ever. The question about dynamics of hidden flow multipliers is central challenge in compiling hidden flow accounts also in other EU member countries. Since the ecological rucksacks tend to change over the years, the development of the HF's should be taken into consideration in MFA accounts. The HF multipliers of import and export flows should also be country-specific, since the ecological rucksacks of same direct material flows varies a lot between different countries.

7. Development of MFA aggregate indicators In Finland

Generally DMI and DMC are regarded good indicators as the data behind them is quite reliable. As the hidden flow data availability is limited and statistical methods used in their calculation are quite robust, the most comprehensive MFA indicators, TMR and TMC are in many cases the weakest indicators. The development of Finnish DMI and TMR from 1945 to 2007 is described in figure 5.

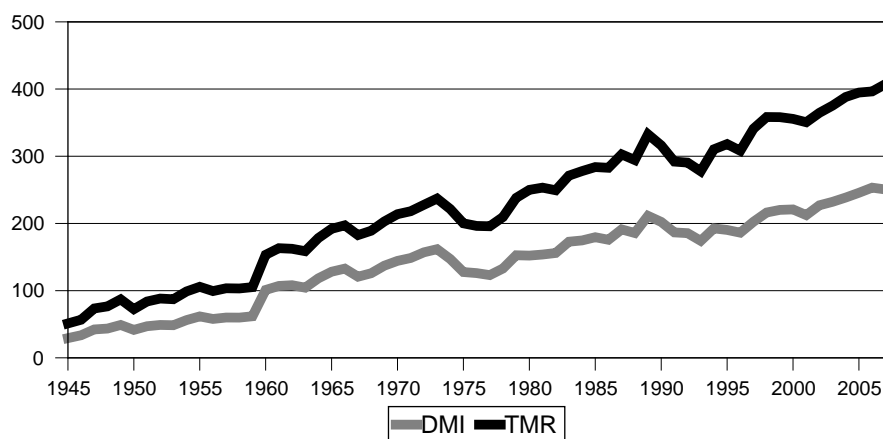


Figure 5. Development of Finnish DMI and TMR -measures in 1945 – 2007 (Million tonnes)

In 1945 the Finnish DMI was some 29.4 million tonnes whereas in 2007 it was over 250.6 million tonnes. Likewise the TMR has grown from 51.2 million tonnes to 407.3 million tonnes during the same period. The trends of both indicators have been constantly growing with no indication of dematerialization or immaterialisation processes.

8. Development of Eco-efficiency of the Finnish economy

The concept of *Eco-efficiency* was first presented by Schaltegger and Sturm in 1990 and was later popularised by Schmidheiny and the Business Council for Sustainable Development (BCSD). The theoretical background to Eco-efficiency comes from ecological economics, especially the idea of a throughput economy presented earlier by Boulding, Daly, Ayres and Simonis. Eco-efficiency seeks to combine economic efficiency and the material efficiency of production with the objectives of sustainable development and the notion of social justice under a single heading. At a general level combining these

points of view means that the use of materials must be reduced in order to minimise adverse environmental impacts while at the same time ever diminishing amounts of materials should produce a relatively increasing degree of economic welfare which is distributed in an increasingly equitable manner (Helminen 1998, 38).

The Development of Finnish Eco-efficiency has been analysed according to EU guidelines by using GDP -data and the material flow aggregates of FIN-MFA Accounting System. The trends of GDP/DMI and GDP/TMR are presented in figure 6.

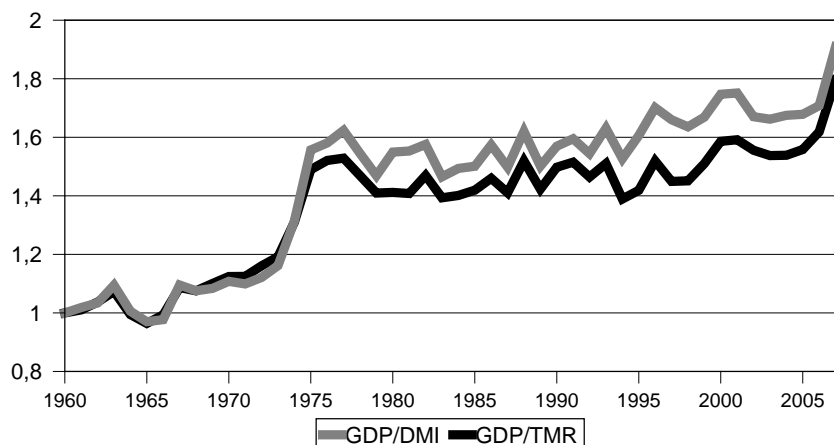


Figure 6. *Development of Eco-efficiency of the Finnish Economy (1960=100)*

Figure 6 gives a quite worrying picture about the development of Finnish Eco-efficiency. Earlier Eco-efficiency analysis based on the Malinda Accounting system suggested improvement by Factor 2.2 in Eco-Efficiency measured by GDP/DMF (see Hoffrén 2001). The improved FIN-MFA accounts cause that the increase in Eco-efficiency is remained much lower that earlier measured. It seems that Finnish Eco-efficiency has almost stabized since 1975 and has then only slightly improved. The economy-wide Eco-efficiency analysis describes only relative changes in input and output variables and forgets the absolute global limits. However, in spite of this shorthcoming Eco-efficiency analysis provides new insight to the functioning of an economy as a whole. (e.g. see Hoffrén and Korhonen 2007, Hoffrén 2006)

9. Conclusions

The Finnish domestic material flow indicators are constantly growing. This also case with the development of material flows of foreign trade. There the main driver has been the growth of hidden flows (ecological rucksacks). Although most increases in past have occurred during 1980's, 1990's and 2000's, their trends seem to be constantly growing. The Finnish DMI and TMR indicators imply no indication of dematerialization or immaterialisation processes as they have been constantly growing. Also the picture about the development of Finnish Eco-efficiency is quite a worrying one. The improved FIN-MFA accounts cause that the increase in Eco-efficiency is remained much lower that earlier measured. It seems that Finnish Eco-efficiency has almost stabilized since 1975 and has then only slightly improved.

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TRENDS AND DRIVING FACTORS IN FINNISH FOREST SECTOR

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1. Introduction

The Development and Comparison of Sustainability Indicators (DECOIN) project dealt with sustainable development indicators and the methodology of analyzing inter-linkages between different trends in the EU. Within the DECOIN project The *Advanced Sustainability Analysis* (ASA), the *Multi-Scale Integrated Analysis of Societal and Ecosystem Metabolism* (MUSIASSEM) and The *Sustainability Multicriteria Multiscale Assessment* (SUMMA) approaches are to be developed into a prototype tool which is easy to use and provides reporting features that are required for monitoring and policy making.

The DECOIN Toolkit has been developed with the explicit goal to keep the relative procedure semantically open. The *multipurpose grammar* conceptual tool has the explicit goal to provide an aid in the delicate phase of coupling: (A) a given issue definition of sustainability (semantic definition of a problem associated with a semantic definition of the relevant attributes) – a narrative about a sustainability problem; to (B) a given formalization in terms of proxy variables (to quantify the relevant attributes of performance) and data inputs (when defining the tokens) required for the quantitative results. By a wise choice of a combination of semantic and formal categories, it becomes possible to develop integrated set of indicators, which can be effectively employed to deal with the particular sustainability issue which has to be investigated.

2. The DECOIN toolkit modelling and analysing approach

In this paper the trend and driving forces behind Finnish Forest sector are analyzed by means of the DECOIN toolkit. A full description of the DECOIN prototype toolkit as well as ASA, SUMMA and MuMIASEM -models are provided in the DECOIN Deliverables D2.2, D3.3 and e D4.4.

The first model, the **SUMMA** (Sustainability Multi-method Multi-scale Assessment) provides a conceptual framework for a system/process evaluation in support to decision-making. In SUMMA the different perspectives are not forced to combine, but retain their full wealth of information, on the basis of which wise decisions can be made, also taking into account important external factors such as social and economic welfare.

The second model, **MUSIASSEM** (Multi-Scale Integrated-Analysis of Societal and Ecological Metabolism) is a multi-purpose meta-grammar approach which explicitly addresses the challenge of handling the quality checks referring to both “semantic quality” – when dealing with different legitimate perspective about what “sustainability means - and “syntax quality” – when crunching numbers referring to different scales and different disciplinary fields e.g. €, Kg and MJ. The MUSIASSEM approach has been developed to provide such a holistic tool. MUSIASSEM can establish an effective link among quantitative representations of the interaction of socio-economic systems and ecosystems in terms of congruent relations. MuSIASEM imposes biophysical constraints. It examines relations between social and environmental aspects. It is also multiscale analysis that is not time-series based. MuSIASEM produces cross-scale constraints to DECOIN toolkit.

The third model, **ASA** (Advanced Sustainability Analysis) is a mathematical information system developed by Finland Futures Research Centre. ASA has used decomposition analysis technique to analyse the factors and effects behind structural change in the economy. It focuses on relations between economic and environmental aspects. The ASA model utilises time-series data and takes best into account the national level. ASA is also able to produce scenarios to extend available time-series data. It can be used to analyze economic development from different sustainability points of view. ASA focuses on relationships between changes in environmental, economic and/or social variables that can be measured with any preferred indicator or index. ASA applies decomposition analysis in order to divide the observed environmental, social and/or economic variables (indicators) into different components, contributing factors. The sum of all identified and decomposed factors is equal to the total environmental, social and/or economic change. ASA can also be applied to scenario construction based on a trend (forward) or a target (backward) as drivers of the analysis. The driver can be chosen freely among the identified factors that contribute to the change. ASA uses time series analysis referring to relevant indicators useful to study the changes in performance of the system under investigation. Then, by performing a decomposition analysis, it can suggest hypothesis about driver and possible causes of analyzed trends. In practise ASA is useful as one wants to analyse reasons to changes in relation to key variable.

When used in an integrated way, the methodologies provide an overview of both the ecological constraints and the biophysical (technical) constraints limiting the performance space of socio-economic systems. This is obtained by tracking the embodied input and output, using a system of accounting capable of tracking: (i) the free services provided by the environment; and (ii) the thresholds of environmental loading that should not be passed to respect ecological compatibility. An overview of the rationale behind this combination is given in Figure1.

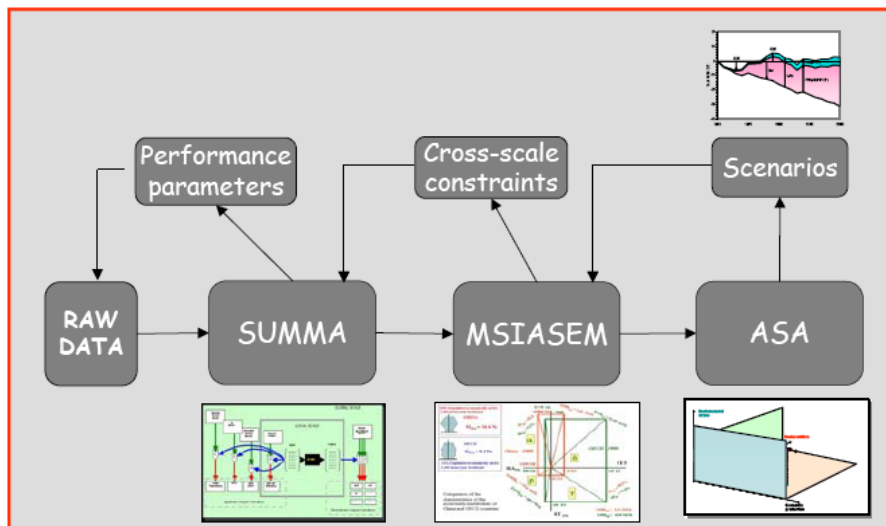


Figure 1. The interlinking of the frameworks of the ASA, MUSIASEM and SUMMA tools

3. Analysing the Finnish Forest sector by using of the DECOIN toolkit

Forests are Finland's most important natural resource. Most of the country is covered by naturally regenerated forests that are in commercial use. Finland has over 26 million hectares of forestry land, accounting for 86 per cent of its total land area. Actual forestland (i.e. productive forest) amounts to 20 million hectares. The Finnish Forestry has been considered as an example of sustainable production sector since the total wood removal does not exceed the annual net primary production. However the forestry has major impact to the biodiversity of the forests. In fact the logging needs of forest industries affected the biodiversity of the forests during last 60-65 years. Also intensive silviculture had negative effects on the diversity of forests, for instance concerning the reduction of the amount of old-growth forests and rotting wood. Thus the way that the commercial forests are managed is of key significance to preserving biodiversity in Finnish nature.

The system budget, also shown in the Figure 2, is composed with the money received as income of productive activities (sale of timber and paper products as well possible sale of self-generated energy exceeding local use). Money is used to pay for imported resources, needed to support the system. Money flows are shown as entering from the right side of the diagram and flowing out as payment for services associated to imports. Each imported flow can be characterized by two energy values (energy – a measure of the environmental support - is one of the methods used in SUMMA): (1) the energy invested by nature in order to actually make a resource (all over the resource life cycle) and (2) a fraction of the energy supporting the whole economy within which resources are processed and made available to the user. This is indicated in the diagram by the interaction of imported goods and services as well as by the coupling of services with money flows (dashed).

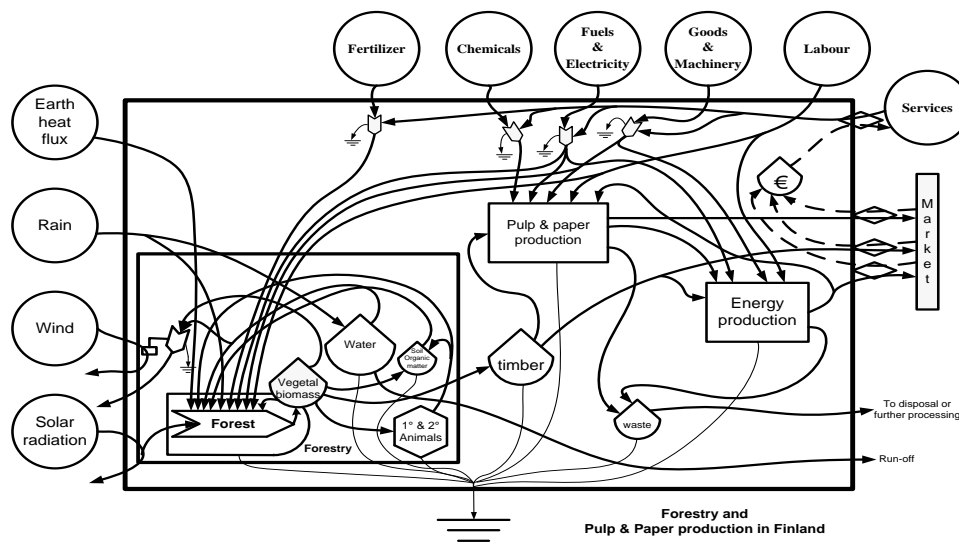


Figure 2. System diagram of Forestry sector and Pulp & Paper production in Finland

According to **SUMMA findings** the largest share of imported input to support the Finnish forestry is constituted by fossil fuels that amount to about 90% and by machinery that oscillate around 10% in the investigated period. The total embodied energy investment was $3.70 \text{ E}+15 \text{ J/yr}$ in 1991, steadily increasing to $4.70 \text{ E}+15 \text{ J/yr}$ in 2006. The forestry sector in Finland is mainly addressed to the Pulp & Paper production, not to the energy sector, although the calculated EROI in the range 14-16 to 1 also indicates a potential energy use of at least a fraction of forest production. The emergy indicators are calculated with and without accounting for the emergy supporting Labor and Services, that is with and without accounting for the emergy indirectly supplied to the system by the outside economy. Accounting for the emergy associated to labor and services provides an important information about the extent to which the system is dependent on the performance of the outside larger scale (i.e. the performance of the fuel industry, the machinery industry, as well as the global dynamics of the life support system to population). In the investigated years, the larger scale of the economy indirectly supported the forestry sector by supplying about 30% of total energy needed for the sector activities.

The aggregate environmental Emergy Sustainability Index ($\text{ESI} = \text{EYR}/\text{ELR}$) calculated with and without labor and services is also more or less stable, but values indicate that the strong dependence of EYR from outside investments (30%) as well as the strong nonrenewability of the system itself (68%) place a significant uncertainty on the overall sustainability of the whole sector. A suitable policy strategy should therefore be the advice of not increasing further the exploitation of Finnish forests, with special focus on trying to avoid forestry for energy. Such a finding, although alarming, is a perfect proof of the need for a multi-method assessment, in order to be able to stress different findings from different methods and reach an informed management decision. Moreover, since several of the calculated indicators are composite indicators, a further disaggregation of their components would be highly illuminating about the driving forces of the investigated trends. Results show that the forestry sector is stable, but shows alarming signs of unsustainability if more extensively exploited.

Several main MuSIASEM application findings are presented in figures 3-7.

Figure 3. The removal of total and commercial roundwood per hour over time

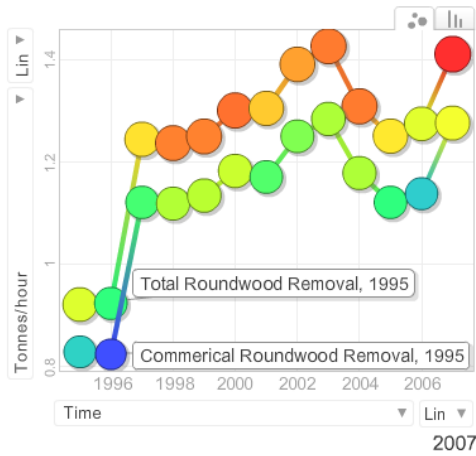


Figure 4. The removal of total and commercial roundwood per hectare over time

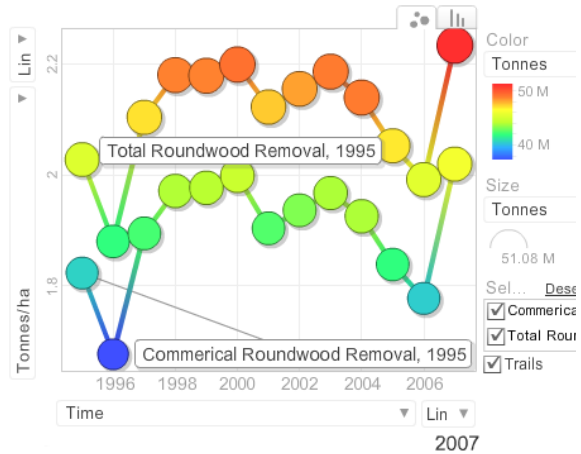


Figure 5. Combing tonne/hectare and tones/hour of roundwood removal (total) over time

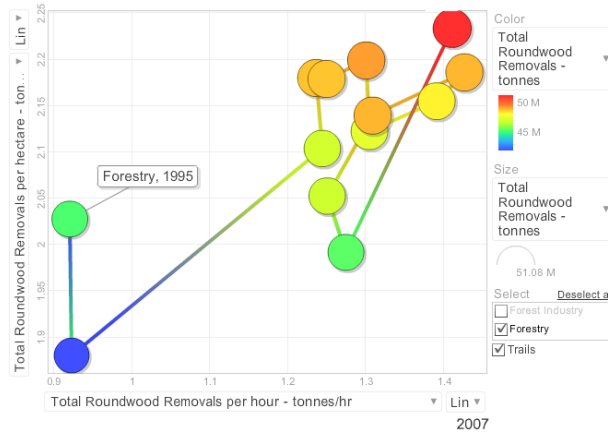


Figure 6. MJ of energy Consumed per tonne of total roundwood removed

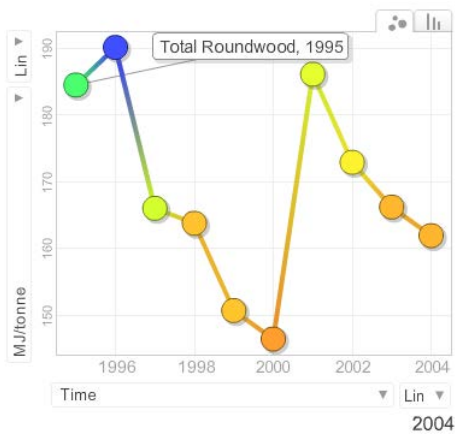
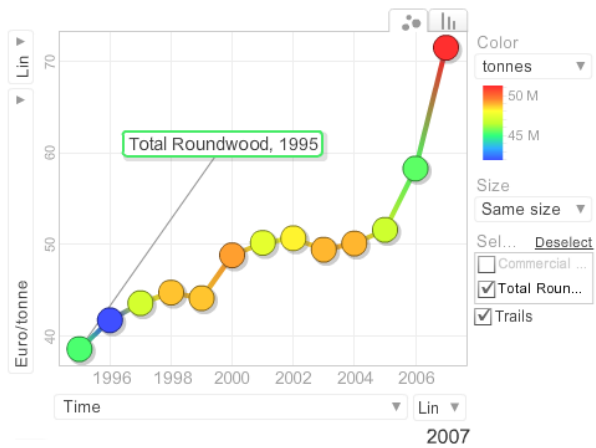


Figure 7. Added Value generated per tonne of roundwood removed



According to MuSIASEM model findings the following conclusions can be made:

- For every tonne of roundwood removal, less energy (except for the peak in 2001) is being used, hence referring to the conclusion that the process is becoming efficient (less inputs needed for more outputs produced) over time.
- Over time, more energy is going into each hour of work in forestry ultimately, leading to the conclusion that more and more roundwood is being removed per hectare and per hour of work over time. The energy used reflects the level of technical capital (machinery) employed in the activity.
- Moreover, each tonne of roundwood is worth increasingly more over the years, probably due to increasing prices in markets of the type of wood extracted in Finland.

Within the scope of this study, Forest Industries have been regarded as the processes that processes the raw material after the first stage of removal of the roundwood. The pulp and paper industry and the wood and wood products industry will be focused upon, while comparing it to the forestry sector at times. In Finland, in general, it has been regarded that the industrial production has been both very material and energy intensive (Braczyk et al, 1998).

The ASA model uses for the decomposition techniques to produce information about factors contributing to environmental burden and thus it explains reasons to different development trends. Since it is very hard to find suitable aggregate measures that describe all environmental hazards, the total carbon dioxide emissions (CO₂) have been used as a proxy of environmental burden. In this case study the variables used in ASA model testing are:

- carbon dioxide (CO₂)
- production volumes (PRO)
- employment (EMP)
- value added (VA)
- working hours (WH)
- final energy consumption (FEC)

For testing in this case study the following equation (1) has been selected :

$$(1) \text{ CO}_2 = \frac{\text{CO}_2}{\text{FEC}} \times \frac{\text{FEC}}{\text{VA}} \times \frac{\text{VA}}{\text{WH}} \times \frac{\text{WH}}{\text{EMP}} \times \text{EMP}$$

For this case study data about Finnish forest sector from 1980 to 2007 has been collected. This data has been inputed to ASA software. The ASA summary table produces results of decomposition analysis in numerical and graphical form. The results are presented as graph in figure 8.

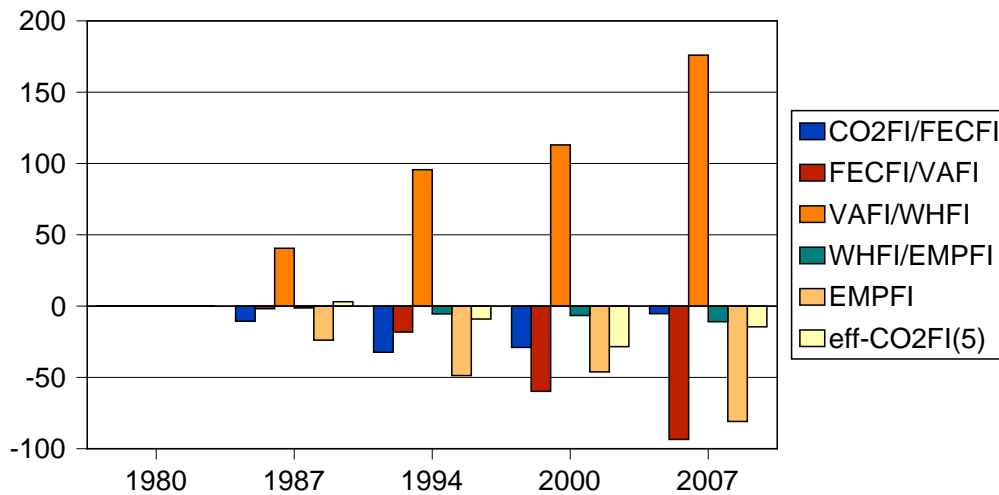


Figure 8. The ASA analysis of Finnish forest industry

According to figure 16 in forest industry increase in value added indicates increases in production volumes due to more machinery. The energy (of fossil fuels) intensity has decreased indicating shifts to renewable energy use. Use of labour has decreased slightly due to more machinery.

In Finnish forest industry increases in production volumes is the major driving force behind increases of CO₂ emissions growth in both pulp and paper as well as in wood industry. All other driving factors have decreasing effects: use of labour, working hours, CO₂ intensity of energy consumption etc. In wood industry the CO₂ emissions have decreased, but not in pulp and paper industry. In forest industry as a whole, CO₂ emissions have decreased only slightly.

4. Experiences from the DECOIN toolkit usage

The Finnish Forestry and Forest sector data provides good testing platform for the DECOIN toolkit. The SUMMA and MuSIASEM results included in this report are produced by the research teams of Parthenope University of Naples (UNIPARTHENOPE) and Autonomous University of Barcelona (UAB). The results produced with ASA model are actually produced by real user, the Statistics Finland team with technical guidance and help from Finland's Futures Research Centre (FFRC). Our experience is that ASA model user interface is in principle easy to adopt and use. Interesting complementary views to different sustainability problems can be generated with relatively easiness.

All DECOIN toolkit models require quite extensive and qualitative precise database. The drafting of relevant diagram on which basis the database was compiled, required both expertise and time. Once the system diagrams were finalised, much of the data desired was not available and it had to be transformed, estimated or even generated artificially. The time spend on statistics compilation exceeded expectations. The DECOIN toolkit provides only as good results as is the quality of input data. As mathematical calculation models they are most sensitive to shortcomings and misinterpretations of data. Furthermore, because of data dependency, the models are unable to discover new unsustainable trends. They only are able to identify unsustainability within existing database. This must be kept in mind when assessing the usefulness of the models.

Within these data constraints, the possibilities to analyse functioning and sustainability of human-economic activities with these models are numerous. Apart expertise to use these models also the

translation of results needs deep expertise and background understanding of the sector you are analysing. Thus the DECOIN toolkit is still very much a tool of environmental experts. The results give interesting new insights to reasons behind unsustainable trends. These findings could be obtained also by other methods or deep expertise, but the toolkit eases and speeds the analysis greatly and thus it redeems expectations.

As the integration of the models into DECOIN toolkit is continuing and there is need to use undoubtedly much more time and resources for the finalisation of the DECOIN toolkit that was estimated in DECOIN work plan. Based on the experiences of this case study, The DECOIN toolkit should be more clearly focused to produce information on some quite specific unsustainable phenomena. For example in the case of Finnish forest sector, the central issues are the loss of biodiversity and the vitality and regeneration capacities of the forests. Consequently, much more framing of the DECOIN toolkit is required, that would also reduce the resources needed to compile relevant databases on the next case studies.

5. Conclusions

The DECOIN toolkit can quite easily produce information about unsustainable trends. These findings can be produced also by other methods or deep expertise, but the toolkit eases the analysis greatly. According to results Finnish forest sector for every tonne of roundwood removal, less energy (except for the peak in 2001) is being used, hence referring to the conclusion that the process is becoming efficient (less inputs needed for more outputs produced) over time. Over time, more energy is going into each hour of work in forestry ultimately, leading to the conclusion that more and more roundwood is being removed per hectare and per hour of work over time. The energy used reflects the level of technical capital (machinery) employed in the activity. Moreover, each tonne of roundwood is worth increasingly more over the years, probably due to increasing prices in markets of the type of wood extracted in Finland.

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2. SUSTAINABILITY IN NORTH-SOUTH PERSPECTIVES

“ JUST BEGIN ”

A CASE STUDY IN CREATING EXPERIMENTAL SPACES IN A TIME OF TRANSITION

Barbara Heinzen, PhD

Coordinator, Barbets Duet

ABSTRACT – *The Barbets Duet (named after tropical birds that sing in duet) is a twenty-year experiment to create the market mechanisms and institutional arrangements that will support people who support the natural world. The founding partners are working with two knowledge systems – African and Western, traditional and modern – to create the social/ecological institutions they need to adapt to a changing world. This engagement has redefined the North/South relationship and its underlying assumptions, throwing new light on this difficult issue. The experiment began in seven learning sites in five countries (five in East Africa, one each in the United Kingdom and USA). It was started by a small group of people who created scenarios stories describing the future of East Africa. This case study will describe the evolution of the Barbets Duet idea from this futures work to the early progress of the learning sites. The results of these initial experiences will be used to see what policy proposals might be emerging from the experience of developing the concepts and practices of the Barbets Duet.*

1. Introduction and Background

Late January 2008 was not a peaceful time in Kenya. The elections held on 27 December 2007 had ended in violence that was horrifying, unpredictable and moving ever more fiercely across the country. Kofi Annan was in Nairobi leading a delegation of people negotiating an end to the bloodshed. Around his efforts were frequent meetings of concerned activists and politicians who traded information, chronicled the spreading insecurity, and searched for some settlement that would avoid a protracted civil war.

In the middle of these troubles, I arrived in Nairobi from London and went to stay with Hilda and Oby Obyerodhyambo at their home in Nkoroi, just outside of Nairobi. Two years earlier, in January 2006, Oby and I had given a lecture at the Royal Society of Arts in London (Heinzen and

Obyerodhyambo, 2006)¹. Our joint lecture was performed as a duet, starting with an African call-and-response. Our style was deliberate, an active illustration of working together in a way that allowed us to learn from both Western and African knowledge. By October 2006, we had drafted the first concept note for the Barbets Duet, a twenty-year experiment in systemic invention. We would draw on African and Western knowledge in order to create institutions that could routinely integrate the imperatives of the natural world in our decision-making and economic rewards.

The following year, 2007, I spent three months in East Africa, India and Europe, testing our concepts with many people. However, by January 2008, it was not clear what should follow, so I stopped in Nairobi to hear what Oby and his wife, Hilda, would advise. I told them that our ideas had largely been endorsed, and asked them what we should do now. Given the surrounding threat of civil war in Kenya, I expected them to say, 'Let's wait until this blows over'. I was wrong. Both said, without hesitation, 'We just begin. You can see that this is needed now more than ever before.' They then offered their family land in Western Kenya as the first Barbet Learning Site.

Within the next two days, I had flown to Dar es Salaam. I was attending a meeting to test the penultimate draft of the East African scenarios. The group in Dar was drawn by SID, the Society for International Development, from all five countries of the East African Community. Most were people I had worked with over the previous ten years when I facilitated SID's scenario projects in Kenya, Tanzania and Uganda, culminating in the East African scenarios we were just completing. Inevitably, given the role of Kenya in the region and the crisis then underway, a good part of our discussion concerned events there. However, during small breaks in the meeting, I asked three of the people who had endorsed our concept note in 2007 if they were willing to create Barbet Learning Sites. There was little discussion – or time for discussion – but all agreed and were joined by a fifth person a few months later.

That year, 2008, was the start of the Barbets Duet. Against the background of Kenya's post-election crisis, five people from Kenya, Tanzania and Uganda, plus myself from the USA and UK, agreed to 'Just Begin', putting our own land, communities and resources into the experiment. In October 2009, everyone with an East African site met in Mlingotini, Tanzania, for our Invention Convention. By May 2010, Woodland Valley Farm in Cornwall, England, had joined us and I had bought land in upstate New York, our first American learning site.

This paper looks at the role of scenario building work in creating the experimental space we call the Barbets Duet. It will describe the initial thinking behind the experiment and some of the results so far. Implicitly, this experiment questions existing assumptions about 'sustainable development', while also offering an ambitious alternative model.

¹ This lecture was held the Royal Society of Arts, London on 26 January 2006, jointly sponsored by LIFT (London International Festival of Theatre) and the Royal Society of Arts and Manufacturing.

2. Materials and Methods

The role of scenario work

Since the early 1990s, there have been several important global scenario projects concerned with sustainability. The Intergovernmental Panel on Climate Change (IPCC) first published scenarios of greenhouse gas emissions and climate change in 1990 (Houghton, Jenkins and Ephraums, eds. 1990). In 1996-97, the World Business Council for Sustainable Development (WBCSD) worked with about forty member companies to produce global, 50-year scenarios on business and the environment (WBCSD, 1997). In 2005, the Millennium Ecosystem Assessment developed scenarios on the future of ecosystems and human well-being. (Carpenter, S.R. et al, 2005)

I was part of the core team facilitating the 1997 WBCSD scenarios and charged with writing up the scenario that postulated markets would manage the environmental crisis. However, this scenario was just a statement of faith, so I wrote a paper titled, “Can Markets Manage Ecosystems?” This showed sustainability would fail if it relied on existing institutions, obliging societies to create new agreements. But how might that happen? (Heinzen, B. 1997)

As the WBCSD assignment was ending, I was asked by Arthur Muliro, a Kenyan at the Society for International Development, to help design and facilitate what became the first of four major public interest scenario exercises in East Africa between 1998 and 2008. SID started in Kenya (Institute of Economic Affairs, Kenya and Society for International Development, 2000), then worked in Tanzania (Society for International Development, 2003) and Uganda (Society for International Development, 2004). This national work was followed scenarios for the larger East African region (Society for International Development 2008b). Each project lasted 18-24 months and, among other activities, included five workshops lasting 2-3 days each.¹

During the national scenario projects, the conversation was dominated by each country’s political uncertainties; environmental challenges were largely ignored. That changed during the East African exercise. First, the team began exploring the competing legacies of Western culture and older pre-colonial African systems. Living with the duality of these legacies became a critical theme, first described in the State of East Africa Report for 2007 (Heinzen, B. and Eyakuze, A., 2007). Second, environmental degradation and climate change became more urgent issues, reflected in the 2008 State of East Africa Report, “Nature Under Pressure”. (Society for International Development, 2008a) Third, participants debated what might happen if East African political leaders repeatedly ignored the needs of ordinary urban and rural people. This theme defined the third East African scenario: “*Usiniharakisho*”- “*Don’t Rush Me!*”. (Society for International Development, 2008.)

¹ To see all the publications produced during these scenario projects and general information about the East African Programme, visit the SID website, <http://www.sidint.net/themes-programmes/east-african-scenarios-programme/>

Feeling for Stones

As I began working with SID in 1997/98, I started to write a book that explored how we might invent ecological societies. First, what could be learned from the experience of those developing countries which had made a rapid shift from agricultural to industrial systems? Second, what could be learned from the pre-industrial history of England? How had the English invented industrial society when there was no model to follow? Third, why had African societies been so rich in biodiversity when European colonization began in the late 19th century? Had African cultures supported high biodiversity? If so, what might be learned from that legacy?

In 2004, I printed *Feeling for Stones: learning and invention when facing the unknown* (Heinzen, 2004). The pre-industrial English history identified important drivers of systemic invention. First, extremity (wars, famine, epidemic disease), shook up existing interests, creating room for new players to discover new ways to meet new necessities. Second, people experimented with very local solutions: new sources of fuel, new agricultural techniques, etc., often using ideas gained from new education. Third, these local experiments engaged people across social boundaries of skill, wealth and knowledge – a skilled carpenter, for example, would work closely with a pioneering landowner who wanted a windmill. The arts were another experimental space, rehearsing important ideas before they were tested in reality. Decades before the English Civil War beheaded Charles I, Shakespeare's history plays asked when it was legitimate to overthrow a king.

These three pairs – Extremity & Necessity, Experiment & Education, Engagement & Aesthetics – became a mnemonic for how English society had invented the Industrial Revolution. Similar drivers – extremity, necessity, experiment and engagement – exist in East Africa today. They offer a vital opportunity to create ecological societies without industrialising first, building on evidence that Africa's high biodiversity has, at least partially, been a product of African cultures themselves. Arguably, East African societies could become centres of systemic invention leading to modern ecological societies while offering new models to more industrialized societies.

African knowledge & ecological societies

The clearest expression of what might be learned from African societies does not exist in any particular technology or ecological insight. Instead, it is embodied in a system of customary property rights that the founders of the Barbets Duet have labeled "Mosaic Rights". Under a mosaic rights system, no one owns the land, but everyone has rights to some benefit of the land under specified conditions. Throughout Africa, different areas have had different systems of mosaic rights depending on the local ecology and the culture that lives there.

Mosaic rights can be contrasted with "column rights" which are most radical in the United States. Here, whoever owns a hectare of land owns the air rights and the mineral rights underground as well as everything in between – a 'column' of rights. These 'exclusive' rights use fences to keep others out. A mosaic rights landscape is crisscrossed by footpaths, because these rights are 'inclusive', offering

everyone some share in the land's wealth.¹ Today in East Africa, both systems co-exist, finely illustrating the duality of living with two contradictory cultures.

From scenarios to the Barbets Duet

The chronic tension between the African and European legacies led SID to decide that donors would not be allowed to attend any of the scenario building workshops. There was already a long and often unhappy history of donor-defined objectives which ignored the concerns and perspectives of East Africans. To avoid that mistake, we took particular care to ensure that the preoccupations of East Africans defined the principal scenario themes. As the only Westerner involved in the national scenario work, I had to be especially guarded in any expression of my own opinions.

However, by the time the SID regional scenario exercise began, my role as facilitator had changed. Several SID staff people in East Africa were now as capable of designing a scenarios workshop as I was, allowing us to function as a highly collaborative team. Participants had also seen the results of their work published without any hidden agendas creeping into the final text. The national workshops had encouraged a degree of emotional daring that was unusual, covering hard, but hidden issues with considerable trust and humour. None of this happened easily or quickly, but it meant that when people reconvened to develop East African scenarios, they quickly explored previously ignored issues. Of these, African knowledge, environmental health and the response of ordinary people to new challenges contributed to the creation of the Barbets Duet.

When Oby and I gave our lecture in London in January 2006, it was – in effect – the demonstration of a relationship that had already changed. However, the success of the East African scenario process had thrown up a new challenge: given what we had learned, what could we begin to do differently? This challenge was not limited to the work in East Africa; if anything, after twenty five years of scenario work in many parts of the world, my greatest frustration came from seeing rapid learning followed by a rapid return to business-as-usual.

Out of this frustration, Oby and I looked back at the lessons of pre-industrial England. Could we begin to create experimental spaces where we could invent supporting institutions that would reward people who restored or maintained healthy habitats and high biodiversity? Could we do this by drawing on the knowledge of both African and Western societies, working with complete equity and mutual respect? Our belief that this was possible led to naming this experiment, the Barbets Duet. Because barbets are tropical birds that sing in duet, they offered both a metaphor and a reminder of how we wanted to proceed. Oby then made a critical observation: we could only succeed by experimenting in open sites where people could see what we were doing. We needed, therefore, to build a network of learning sites in East Africa and the West where people would experiment and demonstrate the results of those experiments to others.

Almost two years passed between the 2008 agreements to 'Just Begin' and the Invention Convention in October 2009. During those months, each person was deciding where to create a learning site and how best to use his or her own resources. What experiments might be possible and how they could be

¹ This distinction between inclusive and exclusive rights was pointed out to the author by Calestous Juma, Harvard University, during a personal conversation in 2009.

financed, organized and integrated with existing professional, community and family responsibilities? None of this was easy or quick. What kept us coherent, were the conversations we had individually or collectively whenever circumstances brought us together.

A Business Idea, Not a Charity

Since 2006, both as sites and as a collective, we have been almost completely self-financed. This is consistent with an early agreement that the Barbets Duet is a business idea, not a charity. As a result, each learning site has raised its own investments and produced its own income. The only exception has been the financing of the two Conventions. In addition to modest donations from two London donors, wealthier partners in the Barbets Duet have contributed to the travel costs of others.

Self-reliance has several advantages. First, we did not need to wait for finance to begin our experiments; we simply started with what we could afford. Second, we had the liberty to develop our own thinking about key principles and concepts. Third, we could move at the pace appropriate to our circumstances and our means. Fourth, anyone who wanted to participate in the Barbets Duet needed to be willing to give something in order to gain something.

3. Results

The work of the Barbets Duet between 2006 and 2011 has had a number of results. ¹

Barbet Sites established

First, there is the establishment of Barbet Learning Sites in East Africa, the UK and USA. Only the site in Rufiji, Tanzania has been delayed, largely because of government directives.

Practical experiments in land management

Second, each site has been experimenting with new ways to use, manage and earn a living from the land. In Tanzania, Msi Choke have been learning how to produce seaweed soap and shampoo, to diversify their income. Both Kenyan sites, at Lukenya and Seme, have built dams to harvest and store water for use in the dry seasons. Several sites have created tree nurseries and tested the viability of different trees, including medicinal and indigenous species.

Fuel crops are also being tested for their viability at different sites – coppice wood and oil seed trees are being planted in both Uganda and Kenya. All sites have encouraged multi-cropping and intercropping. Some traditional crops, such as sorghum and millet, have replaced maize, increasing both diversity and resilience. In Molo, Uganda, two fish ponds have been dug and one has been stocked. At Woodland Valley Farm, two pastures have been replanted with permanent herbs and grasses,

¹ All quotations in this section are taken from the confidential notes of the Barbet Partners Meeting held at Nkoroi, Kenya, in August 2010. A summary of that meeting is available at www.barbetsduet.com → Events → Conventions. [Accessed 12 May 2011].

allowing for winter grazing and carbon sequestration. Both partners at Rufiji, Tanzania and Hannacroix Creek, USA are committed to participating in the carbon markets.

Gathering Together for Shared Learning

The most appreciated result of the Barbets Duet has been the experience of sharing knowledge whenever we meet. At the October 2009 Invention Convention in Tanzania people described their sites and ambitions for the first time, and took lessons from Msi Choke's seaweed farms and commercial experience. In August 2010, a smaller group of partners met at Nkoroi, Kenya for an in-depth discussion of experience and lessons learned. In April 2011, Machano Alli and Mwajuma Mabewa from Msi Choke traveled with Mwajuma Masaiganah and Barbara Heinzen from coastal Tanzania to visit sites in Kenya and Uganda. This 'Safari Convention', showed off key experiments at each Barbet Site and stimulated impromptu lessons on local medicinal plants.

As Coordinator, Barbara Heinzen has been to all sites, but others have also made individual visits. Prior to the Safari Convention, Mwajuma Masaiganah, Oby and Hilda Obyerodhyambo had been to Sammy Muvelah's Lukenya site near Nairobi several times. In February 2011, Oby took advantage of an assignment in London to spend two days with Chris Jones at Woodland Valley Farm in Cornwall. In 2010, Sammy Muvelah spent a day in Western Kenya, touring the Barbet site at Seme. Reporting on that visit, Oby remarked: *"I would really like to emphasize the benefit of cross learning. ... There are things we have been trying to do, but we needed a sounding board ... with Sammy's visit, I had the benefit of someone else's experience."*

Conventions and visits strengthen commitments and offer timely peer review. When Sammy Muvelah told people at the Invention Convention he would be planting moringa trees, he felt obliged to follow through. Eighteen months later, in April 2011, he was showing how well the moringa had survived the drought. As Mwajuma Mabewa from Msi Choke remarked afterwards, *"There is feedback and follow-up in the Barbets Duet. People do what they say they will do."*

Wider learning

In addition to the learning that takes place between members of the Barbet Learning Sites, there has also been wider learning beyond each site. The Msi Choke Cooperative routinely works with other coastal people to introduce seaweed growing and increase supplies that can be jointly sold. In Molo, immediate neighbours across the stream and some government people have taken an interest in the fish pond experiments. Magode Ikuya reported, *"... [Following] our discussions with the other side of the stream, after we finish these ponds, we can now create a small bridge to the other side... Hitherto, they had to go 10 miles around to cross the stream ... We can get similar things going on their side of the bank by easing communications."*

In Lukenya, Nairobi people have come to learn about the tree plantations, while two neighbours now sell tree seedlings based on Sammy Muvelah's example. In Seme, two students worked with a young British intern to plant a siala tree plantation, to be coppiced for charcoal and building poles. The three young men also tested a biodiversity index on the Seme site, creating a baseline number for monitoring the future recovery of biodiversity. When the index was presented to members of MIAFI in Molo,

Uganda, it attracted great interest. Before joining the Barbets Duet, Ugandan farmers had taught African methods at Woodland Valley Farm after Chris Jones converted farm buildings into accommodation for school groups and others interested in ecology and organic farming. Oby and Hilda Obyerodhyambo are now thinking of ways to adopt his ideas.

Introducing African Ideas in the West

There has been routine documentation of what is being done and agreed. This has been posted on the web for wider dissemination, creating an archive of the learning experience behind the Barbets Duet (Heinzen, B. n.d.) There has also been an on-going effort to “make our thinking familiar” as Magode Ikuya put it. Much of this has taken place in individual meetings or talks given to various groups. These talks have often served to introduce African ideas into western societies, with Mosaic v Column Rights resonating quickly and provocatively with many audiences. While African partners are used to adapting to the unpredictable events, the metaphor of “feeling for stones” has been especially useful in Western societies more accustomed to ‘command and control’ management, often divorced from the logics of the natural world.

Utu Net Benefits

During their meeting in August 2010, the partners used the phrase “Utu Net benefits” to describe the wider value of their work to their immediate neighbours and the local environment.¹ The water dams at Lukenya and Seme are used by local people and not just the owners of the land. In Molo, Uganda there are plans for restoring riparian vegetation. As fences are too costly, clan agreements will protect reforested communal land and decide its uses. At Mlingotini, Tanzania earlier conflicts have been reduced as fishermen now appreciate the value of seaweed cover for spawning new populations of fish.

Lukenya offered the best example of Utu Net benefits when the first dam for harvesting water failed. When Sammy reported this to his partners, his dismay was clear to all. *“I sat there. It had just rained. It was big, it was dug humanly ... and then it rains and I lose all the water. ... the guy ... comes to show me where it ends up. So that place is green in the middle of nowhere.”*

Oby looked at the leak from another point of view: *“It is a wonderful metaphor for the communal thing, because nature will conspire to redistribute resources. The man knows the source and he is grateful that he now has a wetland.”* There was another result. Noticing a better dam site on his neighbour’s land, already in use by local people, Sammy arranged to improve the dam, but shared the costs and benefits with his neighbours, creating a new mosaic rights agreement in the process.

¹ Utu Net comes from the SID Tanzania exercise. “We could be described as a network of connections and relationships, of rights and obligations to each other: within our families, ethnic groups, beliefs, neighbourhoods and at work. These relationships of interdependence might be called our ‘utu’. ... We are also a people with a strong connection to the land and its life – plants, animals, fish, and birds. With more than two-thirds of us still living on the land, our net also includes this wider world that supports us.” (Society for International Development, 2003).

Useful Principles

An especially important aspect of the work of the Barbets Duet has been the search for useful principles, both for the collective and for individual sites. These principles are constantly evolving, based on experience and what is needed, as set out below.

The first cluster of principles began as the working assumptions behind the whole Barbets Duet experiment. These were restated at the 2009 Invention Convention. On that occasion, the Partners also began thinking about what principles should define the governance of the collective, quickly agreeing three very simple statements about the relationship of each site to the collective. (Barbets Duet, 2009) In August, 2010, at the Partners meeting in Nkoroi, a third set of principles began defining the foundations of a Barbet Learning Site (Barbets Duet, 2010).

Working Assumptions of the Barbets Duet Experimental Space

- *Multiple experiments: Multiple experiments, in multiple learning sites in different ecological and social settings will stimulate rapid learning.*
- *Equity & engagement: By engaging equitably with people across boundaries of knowledge, power, skill and culture, everyone will learn more rapidly what can and cannot be achieved.*
- *Give & gain: This principle recognises that everyone has something to offer and something to learn. (Project Phakama, n.d.)*
- *Mosaic rights: Property rights need to reflect the needs of ecological economies which are quite different from the needs of industrial economies. A key principle of the Barbets Duet is that the African legacy of 'mosaic rights' will better support environmental markets than the column rights of industrial society. (Barbets Duet, 2009)*

Initial Governance Principles Defining the Relationship of Learning Sites to the Collective

- *Each Barbet site evolves in its own way to its own conditions.*
- *There is value in coming together.*
- *The organizational form of that coming together will be one in which we all have a stake and all share the responsibility. (Barbets Duet, 2009)*

Principles That Help to Establish a Barbet Learning Site

- *Barbet activity is Consistent with Its Site: The site determines what happens, growing out of its ecology.*
- *Learning by Demonstration: How do you foster learning? By demonstration. You show what can work.*
- *Just Begin: But begin with something that can bear fruit quickly. Something enticing and exciting, e.g. at Lukenya, a tree nursery is being imitated by others. The nursery is an end in itself, then the fruit you sell or the wood you coppice is the later achievement.*
- *Thinking Step by Step: Every process follows on another one. In Molo, a new fish pond fosters the idea of a bridge which will foster the learning on the other side of the stream.*

- *Shape Environmental Ambitions around Immediate Needs*, e.g. income opportunities, food security and other critical questions of life & livelihood.
- *Follow the Path of Least Resistance*. Start with what is most possible. This is easiest where ownership & control are in our hands, but might also include other approaches, especially to power which can help or hinder us. You need to understand how power operates.
- *Utu Net Benefits*: Benefits are widely defined: to us personally, to the community around us, to the environment. (Barbets Duet, 2010)

As ‘rules of thumb’, these principles are open to evolution and amendment. Governance issues, in particular, are still evolving. Partners will work to understand what might be appropriate and effective, especially as new sites join. There is a possibility that older African institutions will offer useful ideas, especially around networked governance when many small units share a common space. Whether that possibility will be realized in practice, however, remains to be seen.

4. Discussion

Scenario building projects in East Africa and Europe have played a vital role in the creation of the Barbets Duet. The European work with the World Business Council for Sustainable Development posed the question whether markets could manage ecosystems and directly inspired the book, *Feeling for Stones*. In East Africa, the Society for International Development created a safe space over ten years for East Africans to discuss the future of their societies on their own terms, without outside interference. This long period of time, and the quality of conversation during those years, created a network of people who learned to explore complex issues in a climate of trust and mutual respect, both personal and cultural. These skills are crucial to the Barbets Duet.

The scenarios also exposed the failures of existing social and economic systems. Older African institutions are failing to support populations that have quintupled in sixty years and now aspire to modern material wealth. Equally, industrial societies are failing to restore environmental wealth faster than it is consumed. In effect, both systems are unsustainable. People in both societies are being forced to create new social and economic systems capable of meeting human needs while respecting the imperatives of the natural world. Scenarios helped us to see that challenge, but they assumed we could imagine, in advance, how to meet it. That assumption is ill-founded because systemic invention cannot be imagined first and then implemented. Instead, as shown by the Barbets Duet, the new system can only emerge, piece by piece, trial by trail.

In this way, the founders of the Barbets Duet have begun to learn about emergence. In developing multiple experimental spaces in different ecologies and societies, they expect new institutions and rules will be discovered and agreed. Over time, these will create a new social-ecological system. Barbet experimental spaces are not shut off from the wider world, but are open to it. They test large ideas (many first explored in the scenarios work) in the small spaces of local lives, responding to the logic of local needs and constraints. That is why Barbet activity is “consistent with its site.” Or, as Sammy Muvelah put it more graphically, *‘Rather than asking how can Lukenya support a Friesian cow, I ask: what can Lukenya support?’* (Barbets Duet, 2010)

This approach necessarily has major implications for the governance of the Barbets Duet. By definition, there cannot be any centralized control. Instead, the strength of the whole experiment lies in the diversity of site ecologies, the diversity and quality of the partners, and the willingness to experiment with one's own resources and learn from others who share a wider experimental philosophy. This quality of experimentation and mutual learning informs everything that is done: failure is not a disgrace, but normal and necessary; instead of control, there is mutual accountability and peer review.

Finally, an important dynamic is the hopefulness, pride and ambition inspired by the Barbets Duet. This came across strongly during the opening discussion of the August 2010 Partners Meeting in Nkoroi, Kenya: *'We should be proud of starting this process,'* said James Magode Ikuya from Uganda. *'It may not be very fashionable in various circles yet, but it is something for the future.'* Sammy Muvelah, from Kenya, echoed this: *'The Barbets today looks like an experiment. We all feel like an experiment. But for me the Barbets is a solution ... We are providing a solution that is lacking across the whole region.'* Rose Lyimo, from Tanzania, compared the start of the Barbets Duet to the founding of the Akiba Bank she helped to create. *'What I am trying to say is that when you put your brains together you are sure to find solutions to your problems. So when Barbara told me about the Barbets Duet, I wanted to be a part of it.'* When the host of the meeting, Oby Obyerodhyambo, welcomed everyone, he echoed this statement. *'It is so important to meet. It seems there are certain principles, and a spirit. Just talking at breakfast we can see that. ... It is a great privilege that you are under our roof, a great blessing.'* (Barbets Duet, 2010).¹

Increasingly, the partners have begun to appreciate that this is not a twenty-year experiment; it is one that will take several generations. There will be immediate gains along the way – otherwise there would be no point in continuing – but wider, systemic change will only be enjoyed by later generations. From that perspective, the Barbets Duet has only just begun.

All this has consequences for policy and for 'sustainable development' as commonly understood. How can any development project manage the time horizons being routinely applied here? What kind of financial accountability is appropriate? What accounting tools and financial agreements will encourage investment? Is there, in fact, any role for the usual development agencies and donors or should this experiment evolve on its own because it will not fit into existing institutional norms? If so, can that evolution be protected long enough to meet its goals? Will the Barbets Duet be overruled by the financial and political interests of today's industrial ambitions? Will emerging environmental markets learn to reward smallholdings like those in the Barbets Duet or will the Barbet Partners have to create markets of their own? This brings us back to the metaphor of the duet: Can similar cross-fertilizing experiments be established between large organizations and grassroots experiments like the Barbets Duet? What would a partnership of equals look like?

The founders of the Barbets Duet have quietly answered these questions by getting on with their experiments, listening to their peers, and telling their stories to anyone ready to listen. What happens after that is the story their children will tell.

¹ Only the summary of this report is available as the full report of the Partners Meeting is still confidential.

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POWERING THE FUTURE OF THE LEAST DEVELOPED COUNTRIES: WORLD BANK'S ROLE IN DEVELOPING RENEWABLE ENERGY IN LAOS

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ABSTRACT – *Current trends in energy supply and use are unsustainable – economically, environmentally and socially. Without decisive action, energy-related emissions of CO₂ will more than double by 2050 and increased oil demand will heighten concerns over the security of supplies. Alternatives to fossil fuels are needed. In the near future millions of rural households in developing countries are likely to seek access to modern energy services resulting in a large increase in carbon emissions. The interest in renewable energy such as solar power is increasing among international multilateral banks and bilateral donors. This paper analyses the problems in integrating climate change mitigation with the poverty reduction objective in renewable energy projects. The main focus is on the World Bank's off-grid program in Laos that has mainly promoted solar home systems. It has been argued that solar power is the best choice for sustainability and renewable energy in developing countries, especially in the very remote locations where electricity grid extension is unlikely in the near future. Unfortunately solar panels have not always been proven a panacea as it was hoped for. Besides small-scale renewable energy, the World Bank has supported and flagged controversial large-scale hydropower development as part of the renewable and clean energy solutions in Laos. Based on expert interviews and village level fieldwork, the paper discusses what these developments tell about the World Bank's role in directing the energy futures of Least Developed Countries.*

Keywords: Renewable energy, solar home systems, hydropower, Laos, World Bank

1. The Twin Challenge of Climate Change Mitigation and Poverty Alleviation

Today most households in the developing countries continue to depend on expensive fossil fuel-based sources, such as kerosene, which are energy inefficient, expensive and polluting. In the near future millions of rural households in developing countries are likely to seek access to modern energy services resulting in a large increase in carbon emissions. Climate change, increasing oil prices and cheapening of various small-scale renewable energy-based technologies such as solar panels, small wind generators and micro hydropower have made so-called off-grid renewable energy solutions appealing option. For example solar energy is seen very promising. According to the International Energy Agency (IEA) solar

power could produce nearly 25 % of global electricity by 2050. (IEA 2011) Solar energy is considered to be extremely potential for the developing countries, most of which are geographically located for optimal absorption of the sun's rays.

Multilateral Development Banks (MDBs) are important actors in the energy sector of the developing countries. They are increasingly interested to combine climate related activities with meeting the Millennium Development Goals. In many renewable energy projects poverty alleviation objective has been integrated to the climate change mitigation – at least on the discourse level. This means that renewable energy projects are expected to create a win-win situation by mitigating climate change and reducing poverty at the same time. However, there are studies showing that the expected synergies are far from obvious, in many cases non-existent (Green 2004, Michaelowa & Michaelowa 2007). Without proven synergies the justification for mitigation projects from official development finance is questionable. This makes it understandable why e.g. in World Bank's policy documents it has been important to construct win-win narratives that stress the potential synergies between the two objectives.¹

This paper contributes to the discussion around the problems in integrating climate change mitigation with the poverty reduction objective in renewable energy projects as well as to the discussion on the role of World Bank in shaping the energy policies in developing countries. This is done by looking at the World Bank's renewable energy projects in Laos, which is one of the least developed countries in the world. The paper will focus on large scale hydropower dam Nam Theun 2 (NT2) and World Bank funded solar home system program. Nam Theun 2 is the largest dam in Laos producing 1070 megawatt electricity and its operation started in March 2010. The electricity produced in Nam Theun 2 will mainly be sold to Thailand, and only 5 % will be used in Laos.

Laos is an excellent example of a country where different energy projects have been implemented or supported by the donors and investors. World Bank has been one of the most dominant actors in Laos both in large-scale hydropower and in off grid rural electrification. By analysing hydropower development and solar power program the aim is to find out how these contribute to the building of alternative and more sustainable pathways for energy production. We also discuss how these programs have been able to achieve the stated objectives of improving livelihood and alleviating poverty as well as increasing access to electricity in climate-friendly manner.

The research material includes World Bank documents and policy papers as well as expert and key-informant interviews and village case studies made in Laos. The expert interviews included e.g. the World Bank, Laotian Ministry of Energy and Mines, and Village Off-Grid Promotion and Support Office (VOPS). The village level fieldwork was done in two provinces, Khammouane province in Central and Champasak province in Southern Laos. Approximate case study areas are indicated in red dot in the map below. Semi-constructed interviews were conducted in altogether six villages where the solar panels had been installed. The case study villages were selected to provide variation in two respects, namely in the village location (near the road vs. remote area) and the period how long solar panels had been in use in the village (long experience from solar panel use vs. newly installed panels). In addition we visited and

¹ The critical discussion related to these synergy narratives relate to the concerns that the motivation of industrialized countries to acquire emission reductions through renewable energy or energy efficiency project in developing countries aid can get diverted to sectors with the largest and easiest mitigation potential from the sectors where the most depressing needs for development and poverty alleviation may lie. (Dutschke and Michaelowa 2007).

made interviews in a village that has been resettled due to the Nam Theun 2 dam. The two renewable energy programs – NT2 and solar home system program – overlap in this paper as the solar home system fieldwork was partly done in the villages that are influenced by the Nam Theun 2 dam. In these villages the electricity is produced, not by the large dam next door, but the solar home systems in their backyard.



After the Introduction, the remaining part of the paper is divided into four sections. The first section analyses the World Bank's understanding and definitions of renewable energy, and the gradual development of the Bank's renewable energy program in developing countries. This is followed by the two illustrative cases from Laos: Nam Theun 2 large scale hydropower dam and solar home system program. Both of the cases seem to have questionable outcomes both in terms of being part of new climate friendly and sustainable energy pathway and in terms of contributing to poverty alleviation especially if looked from long-term perspective. The final section concludes the paper and discusses what the findings from the two cases tell about World Bank's current renewable energy policies.

2. World Bank and its commitment to revolution in renewables

The development banks have become part of global energy governance structure. The Multilateral Development Banks such as World Bank and Asian Development Bank (ADB) have an influential role in the formation of energy policy agendas in developing countries. World Bank Group is the largest single source of funds for energy projects in the developing countries (Tripak & Adams 2008, 144) However, it is not only the World Bank's financial lending, but also what it says about development, that shapes other multilateral, bilateral, and national development strategies and defines conventional wisdom on global development. (Weaver 2008, 10) Development banks' economic and technical assistance projects

and programs both reflect and shape global agendas on how countries should develop their energy structure and run their economies. (Florini & Sovacool, 2009) In relation to current energy policy it is of great importance to understand how World Bank is articulating the relationships between the current main three energy objectives - energy security, climate change mitigation and access to energy for the poor.

World Bank and other Multilateral Development Banks view electrification as necessary component of poverty alleviation and development, but the argumentation on which the development banks base their energy policies have changed from decade to decade. In 1980s the banks basically only funded construction of energy infrastructure funding mostly coal, oil and gas projects. In early-1990s a new policy focus emerged; the banks began to emphasize the importance of privatization of state monopolies. The Banks started lobbying for the restructuring of public energy services, privatization of state-owned electricity companies and increasing share of private investments. The hopes for privatization were so high that donor spending on infrastructure fell: the World Bank's lending for energy infrastructure investment declined by 50% between 1993 and 2002. Also during this period by far most funding went to fossil fuel projects and grid extension. At the end of 1990s faced by severe criticism especially from environmental groups the banks began to integrate environmental and poverty reduction concerns to their energy policy. (Kaisti & Kähkönen 2010.)

Besides privatization, also another major change began at the end of 1990s and early 2000s, namely a climate turn in World Banks energy portfolio. World Bank had been strongly criticized for the climate impacts of the fossil fuel projects the Bank was financing in the developing countries and the Bank began to emphasise more clean energy and climate-friendly low carbon solutions including different renewable energy and energy efficiency projects. Also the price of oil increased rapidly which made the Bank even more interested in renewable energy. Even nuclear is a recommended low-carbon option for some countries especially in East Asia, even though the banks are not ready to fund it themselves. This in the World Bank vocabulary is called clean energy revolution. (World Bank 2010, 1)

These tendencies have been manifested in the responses of the World Bank to the Extractive Industries Review (2003) which was commissioned by the Bank itself and in which the criticism the Bank had faced very much culminated. The Review called the World Bank to re-consider its projects that most strongly contribute to climate change – particularly projects on oil and coal extraction. It also recommended an immediate moratorium on coal, a phasing out of investments on oil by 2008 and that the resources to energy investments should be devoted to renewables. In the following year there was a series of responses from the World Bank Group's side. It referred to its past commitments by announcing that since 1990's it had directed \$6 billion to renewable energy and energy efficiency investments (World Bank 2004a). In the report World Bank Group also announced its future commitments by stating that it was "*committed to nothing less than a revolution in the rate and scale*" of investments to renewables (World Bank 2004a, 2) Very soon after this the targets were specified in a press release where it was announced that the WBG will commit 20% annual increase in finance of renewable energy and energy efficiency projects (WBG 2004b). This target has been later started to be called as the Bonn Commitment. After the bold announcements of Bonn Commitment the Bank was faced with contestations that question the figures WBG had presented. One report from Sustainable Energy and Economy Network (SEEN) accused World Bank Group for "renewable deception" (Vallette et al. 2004). The SEEN report claimed that according to their calculations of \$6 billion only 1,65 billion

was put on projects predominantly focused on energy efficiency and renewable energy, 3,23 billion was for projects that contained multiple components most of which were unrelated to renewable energy or energy efficiency and that 1,33 billion was put in projects that according to SEEN did not match at all with the Bank's definition of renewable energy. And in the case of future commitments, although the percentage was in line with EIR recommendations, the baseline chosen was claimed to be very low, so that the 2005 target was actually lower than the Bank's loans for renewables 10 years earlier in 1994. The report stated that if the Bank had truly supported over 6 billion in renewable energy and energy efficiency since 1990 and would have built its baseline for past 10 years, its future commitments would have needed to be more than double (that is approx. \$400 million a year instead of the Bonn Commitment's \$200 million a year). The World Bank figures on its energy portfolio have continued to be contested until now (e.g. BIC et al. 2006, WWF 2008, SEEN 2007, BWP et al. 2010, WRI 2010).

Also the definitions and categorizations related to renewables have undergone interesting changes, especially in relation to large hydropower development. For example in a World Bank report from 2004 published at the same with the Bonn Commitment there is no distinction made between renewables and new renewables. Also the so called Bonn Commitment was announced first only as commitment to renewable energy. Later on, however, the World Bank stated that it considers all hydropower regardless of scale as renewable and emphasized a difference between renewables and 'new renewables' where the latter includes only small hydropower. And later on the Bonn Commitment has been defined as commitment to new renewables. World Bank clarified that even though it regards large hydropower as renewable it will for reporting purposes give separate figures for projects in which installed capacity exceeds 10 megawatts. But in many instances this has not been the case.

This shows that the climate turn in World Bank's energy portfolio has been facilitating the comeback of large hydropower which was already considered as belonging to the past after the criticism it faced in the end of 1980's and during the 1990's. The public concerns about the risks relating to environment, water equity, population displacements and social justice issues led World Bank withdraw from large and controversial hydro power projects. World Bank funding for hydro power projects declined due to protests and lawsuits around hydropower and in 1999 the Bank did not fund any hydro power project. (McCully 2001; Berliant 2009) Along with the establishment of the World Commission on Dams and its famous report (WCD 2000) problems related to large-dams became widely acknowledged. It seems that as the agenda of climate change has increased its importance – so has the Bank's efforts to show that it can be the leader for the renewable energy revolution. And at the same time hydropower that during the 1990's was one of the most contested sector of World Bank's energy finance has experienced a renaissance. 2003 has been the year of clear come back of hydropower funding – World Bank approved 67 projects. Since then new lending has increased significantly: from less than \$250 million per year from 2002-2004 to \$500 million per year from 2005-2007. In fiscal year 2008, the lending exceeded \$1 billion. (World Bank 2009.) Especially the large scale hydropower projects have continued to cause concerns about the environmental impacts, human right violations, technical problems and displacement of people. For example, the World Bank's financing of the Bujagali hydro power project in Uganda and Nam Theun 2 in Laos both have provoked protest campaigns.

What comes to 'new renewables', they are considered by the World Bank as an important tool for both poverty reduction on one hand, and low-cost and effective opportunity to reduce future growth in greenhouse gases on the other hand. According to the Bank itself, over the last six years, excluding large

hydropower, new renewable energy investments contributed approximately \$4.2 billion. ^[2] One critic on this figure is that it includes also carbon finance and the funds of Global environment Facility (GEF) even though carbon funds come independently of Bank's own funding and GEF is a different institution the Bank only administering the funds (Bretton Woods Project 2010).

A significant part of the smaller scale renewable financing is formed by solar home system programs. World Bank together with Global Environment Facility (GEF) have financed them since 1992 both in Asia and in Africa. It has been part of Asia Alternative Energy Program (ASTAE) that was established the same year by the World Bank and key bilateral donors. ASTAE's mission is to mainstream alternative energy (renewable energy and energy efficiency) services in all Bank sectors, with priority emphasis on the Asia region. (www.worldbank.org) Lessons especially from the early solar electricity experience showed that the projects faced a myriad of difficulties in terms of technical performance, financing, marketing and implementation. (Martinot et al. 2001)

Next we will turn to Laos and look at two exemplary World Bank funded energy projects there. Laos has been the main scene for the return of World Bank in the hydropower development. It has also been the country where the World Bank and GEF funded off-grid rural electrification program mainly consisting of solar home systems has been claimed to be one of the most successful one. Through the cases of Nam Theun 2 hydropower project and the solar home system project we try to shed light to World Bank's role in fostering revolution in renewables and at the same time alleviating poverty.

3. Laos as the stage for World Bank's return to hydropower

Mekong region and Laos are an illustrative case of how the climate change agenda has been re-shaping the dam debate. World Bank together with Asian Development Bank (ADB) have attempted to use the climate change debate for greening the hydropower projects. Despite of all the controversies, large hydropower is now increasingly presented as "clean energy" and the environmental concerns on climate change mitigation and adaptation are seemingly over-riding the other environmental and social concerns. The current World Bank experts' vision that the regional electricity grid the Bank has been promoting for decades assures that the region has access to clean, renewable energy produced by the large-scale hydropower dams located principally in Laos but later possibly also in Cambodia. Especially Laos, which has large hydro power potential, sees electricity as its main future export commodity. The electricity would be exported to those neighbouring countries which have rapidly growing economies and increasing energy consumption. So Laos is not anymore presented only as the battery but the green battery of Southeast Asia. The energy security, regional trade and environmental issues in terms of climate change objectives are all presented in a win-win manner that paves the way for hydropower development. Due to the many negative social and environmental consequences and the distribution of income from electricity export remains unclear. Therefore also alternative and complementary solutions in electricity production and options for increased energy efficiency should be investigated. However, in the World Bank's vision the smaller scale renewable options consist of small off-grid programs

^[2] Source: World Bank web page:

<http://web.worldbank.org/WBSITE/EXTERNAL/NEWS/0,,contentMDK:21513875~menuPK:34480~pagePK:64257043~piPK:437376~theSitePK:4607,00.html> (as of 30 August, 2010)

(discussed in more detail in following sections) that seem to serve more as a complementary pre-electrification strategy rather than an alternative pathway.

The concerns on environmental impacts of large hydro power dams, and on security of local natural resources and fisheries based livelihoods seem to have taken a backseat in this vision. Also the questions on e.g. emissions from the large reservoirs that especially many of the Mekong tributary dams, including Nam Theun 2, involve have been so far left unanswered. The support for large-scale dams seems not be limited only for Nam Theun 2. In World Bank Group's report "Development and Climate Change: A Strategic Framework for the World Bank" support for new large-scale dam development in Laos has been used as an example how the Bank Group is focusing on "*scaling up operations in the field of renewable energy and green energy.*" The report announced that MIGA is prioritising development of new applications of renewable and energy efficient projects and that it "*identified new leads and opportunities that include*" new large hydro developments in Lao PDR. (World Bank Group 2008, 40.)

3.1 The Poverty Alleviation Potential of Nam Theun 2 Under Questioning

Nam Theun 2 dam is jointly implemented by the Nam Theun 2 Power Company and the Government of Lao PDR and supported by financing from 27 parties including the World Bank and Asian Development Bank. The main investors are from Thailand and France, but the guarantees for millions of dollars of loans come from the World Bank and Asian Development Bank. Because of the 1990's legitimacy crisis of large dams Nam Theun 2 is an important project for World Bank. It is a kind of show case to the world by which the Bank wants to demonstrate that large dams can be built sustainably. And indeed the investments in the resettlement have been higher than ever and there are programs developed to create alternative livelihoods for affected communities in downstream of the dam site. Also there are unique mechanisms set in place to assure that the government of Laos uses earnings from the dam operation to poverty alleviation. In terms of environment the project has included for example vast watershed conservation areas. Nam Theun 2 Power Company provides 1 million USD per year for globally significant Nakai-Nam Theun National Biodiversity Conservation Area and World Bank assisted in establishing the Watershed Management and Protection Authority (WMPA) responsible for the management of the area. This fund has been interpreted as a way to sell the project to environmental groups and for some organisations such as IUCN this in fact was crucial in shifting sides from opposing to endorsing the project (Goldman 2005). But one of the core objectives and the main interest from NTPC side is the "*protection and rehabilitation of forest cover in the Nam Theun 2 watershed Area to assure adequate water flows with low sedimentation to or away from the Nam Theun 2 Reservoir*" (from WMPA website). This objective then is stated to provide also long-term biodiversity conservation. However, as the International Rivers has pointed out the establishment of the reservoir provides new access to the areas that have earlier been very difficult to reach, which is exacerbating logging and poaching and threatening its ecological integrity (Lawrence 2009).

Several other controversies over the dam also remain. Tens of thousands of people living downstream along the Xe Bang Fai River have already suffered impaired water quality and from declined fisheries and the schemes for alternative livelihoods have at least not yet been proved successful in truly mitigating the negative impacts. Also the situation of the resettled 6200 people, mainly from ethnic minorities living on the Nakai Plateau, remains to be under heated discussion (Stone 2010).

Whereas World Bank claims that the project has succeeded in lifting all the households above the poverty line, critiques maintain that there is not yet enough evidence of longer term sustainability of the newly introduced livelihood patterns. Because all of the grazing land is now either permanently or seasonally under water the families have needed to give up their traditional livelihoods of buffalo raising. The land allocated to each family is resettled village consists of only 0,66 hectares and the quality of the soil seems not to be very good. The future of the fisheries stock in the reservoir is still uncertain as well as the prospects' for tourism.

Also within the protected area of upland Nakai-Nam Theun - National Biodiversity Conservation Area, there are also many questions raised over the sustainability of the local livelihoods. There people are encouraged and even forced to stop their swidden agriculture of slash and burn cultivation. But it is not yet so certain if there are successful alternative income generation activities. Even though the project wants to highlight the poverty alleviation objectives, more emphasis is put on controlling the activities of the locals.

One argument questioning the positive impacts of the project is that Nam Theun 2 actually hindered positive development in the area before the project started. A field trip report of international NGOs visiting the area in 2003 stated that :

Development on the Nakai Plateau has apparently been overlooked for years. According to the NTPC official, the donors' focus may have been on other areas because they presumed that NT2 would ultimately provide assistance to Nakai villagers. Additionally, given the impending flooding of hundreds of square kilometers of the Plateau, donors may have prioritized other areas where their investments would be more sustainable (and free from potential NT2 controversy). Now the project proponents are using this situation of neglected development, among other arguments, to make the case that the project has to be implemented without delay. (Les Amis de la Terre et al. 2003)

The contribution of the income generated by the export earnings of electricity for the government is of course very significant. But it is important to keep in mind that Laos is ranked by Transparency International as one of the 10 most corrupt in the world. Therefore, there are no guarantees that the revenue from the electricity exports to Thailand will be used to benefit the poor, especially those who have lost their livelihood due to the dam. Nam Theun 2 is forecasted to generate an average of US\$80 million annually in direct revenues for the state in the form of taxes, royalty charges and dividends over the 25-year concession held by Nam Theun 2 Power Company Ltd. After this, the Project will be transferred to the Government and all revenues will thereafter accrue to the Lao state. (www.powerinprogress.org) The fear is, however, that due to sedimentation the electricity production capacity will lower significantly after the concession period. So the revenues in longer term future may be smaller than expected now.

An interesting fact related to the claims of NT2 being part of climate mitigation strategies is that the size of the reservoir area is remarkably large. It is also unique in the sense that in rainy season it covers 450.000 hectares but in dry season only 8000 hectares. This means that the reservoir can be a significant source of methane. According to some interviewed experts there are calculations done on green house gas emissions of the reservoir but these have not been made public. It is possible that this is done in order to avoid the questions on the dam's climate friendliness.

4. Solar Home System Program in Laos: Sustainable Alternative or a Temporary solution

Laos is one of the countries where the World Bank is funding a small scale renewable energy electrification program. The World Bank's and the Lao government's off-grid electrification scheme began in 1998 with the installation of solar home systems in seven provinces.¹ The solar panels were targeted to the rural areas where the electricity grid is not extending at least in the next five years. The pilot program was expanded to larger Rural Electrification Program in 2005. By the end of 2009 about 15.000 households had been electrified by solar home systems. Originally the off-grid program was planned to include both solar home systems and village scale hydro power, i.e. micro hydro², but finally only solar home systems were used.

Despite of the difficulties in other countries, in Laos the solar home system program has been defined as a success story both by the World Bank, Government of Laos and the program coordinator Village Off-Grid Promotion and Support office (VOPS). The program was especially established to support the Lao government's National Growth and Poverty Eradication Strategy, and it had poverty reduction element. The stated objectives of the program were, firstly, to provide electricity to villagers in remote areas of Laos where the electricity grid will not reach in the next five years, secondly to provide support to renewable energy utilization for rural villages in order to protect environment and natural condition, and thirdly to help poor people by providing electricity for income generation activity in order to improve their quality of life. (www.vopslaos.org) Solar energy, or more specifically solar photovoltaic electrification, was promoted as a way to increase the access to electricity in remote rural areas and to improve livelihood options. The development of lighting conditions is believed to increase the income-generation activities that are performed at night such as doing handicrafts. Furthermore, extension of the electricity to public institutions, such as schools and health clinics, improves also basic services in remote areas

The basic idea of the program is that the solar panel user will pay a monthly fee and after the payment scheme is completed, the user will own the panel. For the end-user the total cost of solar home system installation in Laos (in 2010) is 3 600 000 kip, i.e. approximately about 360 USD. The panel user can pay the whole sum also at once, but it is rare. Normally it takes 5-10 years to pay the total sum in monthly payments. The usual monthly fee is 30.000 kip (about 3 USD) for 10 years. After the payment scheme is completed the user owns the panel. The battery to store the energy has to be changed every 2-5 years depending on quality of the battery. The costs of battery and light bulb changes have to be

¹The provinces were situated in the Central and Southern Laos and included (Bolikhamsai, Khammouane, Savannakhet, Saravane, Champassak, Attopeu, and Sekong.

² The World Bank's off-grid electrification also included village micro hydro facilities. Despite of the many feasibility studies, the village hydro component was never very successful. According to the VOPS officials, the reason for this was that village micro hydro facilities are much more complicated to plan and install because they demand feasibility studies and collaboration of many public and/or private developers with sufficient funds. As a result, village micro hydro facilities were not installed. (Interview with VOPS officials on 14 Jan. 2010)
The definition of scale in hydro power: "small to large hydro power" > 1 MW; mini hydropower < 1MW; micro hydropower < 100 kW; pico hydro < 1kW

covered by the users. A new battery costs approximately 700 000 kip (70 USD) which makes it an expensive investment for the poorest solar households.

With 30.000 kip monthly fee the user would get a 50 W panel which gives electricity for 2-3 hours per day. The most common uses of electricity are lighting, TV and stereos. Water can be pumped by using solar PV pumping. Applications for using direct solar radiation include solar cookers, solar water heaters and solar dryers.

4.1. Why Solar Home Systems?

Originally the World Bank's off-grid program in Laos was planned to include both solar home systems and village scale micro hydropower. Laos has significant potential for hydropower, and if planned and implemented properly, micro hydro could offer a good alternative for sustainable small scale electricity production in Laos. In the off-grid program many feasibility studies were made to examine the best locations for micro hydropower that would produce electricity for a village or a group of villages. The overall goal was to achieve 10 000 electricity connections – 9000 with solar energy and 1000 with micro hydro. Despite of 15 feasibility studies no micro hydropower plant was implemented in the World Bank's program. Instead, solar home systems were used in the program. There were many reasons for this. One of it was financial; the price of solar home systems went up and there was no longer money for micro hydro in the off-grid program. Also it was calculated that the solar energy would be cheaper for the end-user than the micro hydro. According to the World Bank official, the total cost for the solar panel (for the end-user) is around 300-500 USD depending on the size of the panel. The cost of the micro hydro for the end-user ranges from 1000 USD to 1500 USD per household. (World Bank official, interview on 15 January 2010)

Even it [micro hydro] is more expensive, the Lao government is trying to subsidize the private sector participation. But the private sector is so weak in this country. There is a lack of technical capacity and for that we have [had] several hundred workshops. Many private sector companies express interest, but they cannot invest. (Interviewed World Bank official)

In short, private sector involvement is required in micro hydro development, but not in solar energy which is subsidized by the World Bank program. Large hydro is lucrative business but micro hydro hardly draws investors. Furthermore, due to the weak banking system, even though there would be interested local private organizations, it is very difficult for them to find funding for micro hydro development. Compared to micro hydropower, solar home systems are easy to install, they don't require feasibility studies or establishment of partnership with private power producers as is the case in much more complex micro hydro. (Interview, VOPS officials 14th January 2010) Also the lack of information and sometimes sporadic planning in the electricity grid extension has hindered the installation of micro hydro plants.

The easiness of solar home systems is probably one of the key reasons why they are so popular among international development banks and other donors. The prices of solar home system components have reduced in the past 15 years, which has increased their attractiveness. Solar energy is considered to be extremely promising, especially in countries with optimal access to the sun's rays and very little other resources. There has also been a certain hype relating to solar energy. According to the International Energy Agency, solar power could produce nearly 25 % of global electricity by 2050. (IEA 2010) The

micro hydro has not received that much attention even in Laos which is famous for its hydro potential. Hydro power potential as significant as in Laos is rare and the World Bank's programs are often global and the so-called best practices are copied and implemented in different developing countries in the world. One of the overlooked issues has also been the common use of very small hydropower, so called pico hydro, which provides similar amount of electricity to household as a solar home system. Around 60 000 households use electricity from pico- hydro in Laos. (Smits & Bush 2009) Despite the fact that pico-hydro is so widely used, the World Bank representatives have questioned the benefits of pico-hydropower in income generation, even though it can be used for similar kinds of purposes (e.g. lighting) than solar home system - but with significantly lower expenses. (Smits and Bush 2010)

It seems that from the World Bank's side the main explaining factor actually is the universal applicability of solar home systems, not its superior local appropriateness. (See also Smits 2008.) Solar home systems are easy to install and use everywhere in the world. From the Lao government's perspective the rationale for SHS preference could partly relate to the better possibility of control the SHS offers compared to the pico-hydro alternative. Smits and Bush (2009) pointed out that the informal nature of pico-hydro means that it exists beyond government control and this is partly why the grid extension is considered as the strongly preferred option whenever possible. But even though SHS similarly to pico-hydro is a decentralised form of electrification it still potentially offers more possibilities for governmental regulation because its implementation is organised through government and the payment schemes of 10 years mean that SHS systems are not entirely outside of the state control.

4.2. Increasing Access to Electricity in the Remote Areas

Next we will look at the off-grid program's objective of expanding the access to electricity in the remote rural areas. This objective did not always work as planned. In Laos there has been a problem with inadequate information on the grid extension plans. In some cases the solar panels were installed also to villages where the electricity grid was extended just months afterwards. The panels were taken back and installed to other villages. (Interview with VOPS officials) Sometimes also influential actors can actually change the grid extension plans to cover a village or an area where the grid was not originally planned. In Champasak province, for example, electricity grid was extended from a mainland to an island because it was requested by highly ranking monks. The island has a special status due to an old and important temple. The island got the electricity line which now crosses the river from the mainland to the island in the air. (Interview with village officials)

High ranking people can alter electrification plans in some cases. For the general electrification of the remote areas much more important issue, however, is the institutional structure of the off-grid program. The logic according which it operates makes the program spread to the easy access areas where the grid is likely to be extended relatively soon, rather than remote areas. To understand this, we should take a look at the institutional framework of the program. The Ministry of Energy and Mines of Laos externalised the management of the off grid program, by setting up a *Village Off grid Promotion and Support office (VOPS)* that operated from 2006 till the end of 2009. From the beginning of 2010 the responsibility of the management of the program returned again to the Ministry when VOPS contract ended and the office closed. The purpose of VOPS office was to provide electricity to 10.000-15.000 rural

households. In order to do that, they established a network of *Provincial Electricity Service Companies (PESCO)* in all provinces. PESCO companies are small local companies that take care of the distribution and management of the solar panels in provinces. They in turn mobilise *Village Energy Managers* that work at the village level and collect the monthly fees and report the needs to the spare parts etc.

Compared to many other often donor-driven solar home system programs (Marinot et al. 2001; Karekezi et al. 2002; Jacobson 2007) the implementation in Laos has been better planned and is working relatively well. The significant problem, however, is that the institutional structure encourages PESCOs to sell the panel to the areas with the easiest access (i.e. where the road connection is good). In the areas where the electricity grid does not reach yet but where the road network is good, the villages along the roads are likely to get solar home systems because it is much easier and cheaper for PESCO to install the panels and collect the fees if they can easily access the villages by car. The electricity grid is likely to be extended along the main roads. As a result, the solar panels tend to be installed in the areas where the grid is likely to be extended soon, and the remote areas remain without electricity.

Therefore, even though the solar panel program is meant for the electrification of the remote rural areas, the panels are mainly spread to the villages along the roads because there is no economic or other incentive for PESCOs to go to the areas where access is difficult. This makes solar panels only a short term solution. But the temporary nature of SHS seems not to be totally unintended outcome as anyway SHS seems to be mostly perceived as a temporary solution:

“Yes, the idea, I suppose, is that, indeed, this is just as a temporary solution for in many, in many villages, hopefully.” (interviewed VOPS official A)

And it seemed to be preferred to be so:

” Everybody needs to have more better life and more satisfaction, you know. Solar is not, is not, the best option, but solar is just for lighting.” (VOPS official B)

To summarise, it can be said that even though the off-grid program is defined as success story, it has not been clearly reaching its main objectives. It seems to be successful in serving as a temporary pre-electrification phase for the areas that are not yet but are likely to be electrified by grid connection in future. But it does not, however, seem to be reaching the most remote areas likely to be without grid connection for several years to come. So even if at the discourse level the solar panel program is intended for the very remote mountainous areas solar where grid extension is extremely difficult, but in reality the program spreads first to the villages along the good roads because for PESCOs it makes sense to first go to install the panels in areas where it is easy to access by the road. This makes also the collection of monthly fees easier.

The explicit expectations of the program implementers were also interesting in relation to the more general stated objectives of World Bank leading a revolution in renewables. If the off-grid, or alternative electrification program, is considered as temporary electrification solution, or pre-electrification phase before the grid connection, they cannot provide an alternative for large scale electrification like large hydro power. As one interviewed World Bank expert stated: “*Off-grid only play a complimentary role in overall electrification, especially in those remote villages that grid cannot reach in short period.*” Thus the decentralised small systems like SHS in Laos do not provide any real alternative to large scale electrification schemes. And in Laos for longer run World Bank seems to be visioning that the viable renewable energy consists of large-scale hydropower distributed to Laotians through centralised grid. The main part of the World Bank funded rural electrification project consists actually of grid extensions.

And the role of smaller scale solutions is simply to either act as transition technology or provide the option for the very marginal areas where it is too costly to extend a grid connection.

4.2. Poverty Alleviation Potential of Solar Electrification

Finally we turn in to the key questions: Is the off-grid program able to alleviate poverty, or to improve living standard, and does the solar home system provide a low carbon option for rural electrification. As the solar home systems were mainly used for lighting, stereos and TV, it did not reduce the use of wood or charcoal in the cooking. It did reduce the use of kerosene for lighting but the climate impact was nominal.

The poverty alleviation is one of the main objectivities of the World Bank program. This has several interesting aspects. Is the electrification program able to provide new sources of livelihood or income? How the monthly costs and the investment in new batteries and lamps affect households? How the electrification affects the living conditions or the general quality of life? In Khammouane province all the case study villages were situated in Nakai district in very remote areas with no road connection.¹ For PESCOs the area is difficult to reach and expensive to go to. The area is very unique in the sense that the area is strongly influenced by the Nam Theun 2 dam. The fact that the villages are in the Nam Theun 2 Watershed Management and Protection Area creates an interesting angle to the electrification: the case study villages in the area were included in the solar panel program as a result of the huge hydro power dam built in their neighbourhood – from which by far most of the electricity is exported to Thailand.

The case study villages were situated in Nakai Plateau in this protection area that covers more than 400 000 hectares of land is biologically diverse area that is also home to 6 000 people from different ethnic minorities.² The area is one of the Laos' poorest. (Interview of WMPA official.) Partly to answer to the critique from the international NGOs against Nam Theun 2, the World Bank established Nam Theun 2 Watershed Management and Protection Area (WMPA) in 2010 and funds it by one million USD per year. One of the aims of the WMPA is to “completely eliminate slash and burn cultivation by 2010”, which is considered to be a threat to the forest cover. (Informal discussion in WMPA base camp) World Bank believes that WMPA brings development to the area. Earlier development programs have failed to increase the living standards or increase rice production. The rice harvest is so small that on average there is only rice for three months of the year. The development schemes have not been able to solve this problem. (Informal discussion in WMPA base camp)

Solar panels had been installed in this area in 2008 and 2009.³ The interviewed solar home system users had been using the panels for less than half a year. Almost all interviewed solar panel users had

¹ Part of the year, when the Nam Theun 2 reservoir was full, villagers living in the case study villages benefitted from the increased water level because the villages could be accessed by a boat. Before this boat access it took 5-6 hours by boat and 2 days walk to reach the villages from the district capital Nakai where the main market and services were located. After the construction of the Nam Theun 2 dam the large water reservoir enabled small boats to reach the villages at least part of the year. It was unclear, however, how long the water way was available as there was very little information in the villages how much the reservoir and the dam would effect their lives.

² Mainly people living in the watershed protection area are from four main ethno-linguistic groups; Vietic, Brou, Tai-Kadai and Hmong.

³ The villagers first saw solar panels when they were brought to the Watershed Management and Protection Authority's base camp was established in 2006. Base camps are part of the watershed management and protection

had to sell a chicken or pig to cover the monthly fee for the panel. For some respondents this was regular way to cover the solar panel costs. (Interviews 19-20 January, 2010) Due to the remoteness of the area the villages used very little cash and were more or less living in subsistence economy. Now the monthly fee forced the panel users to shift more to monetary economy. In this situation the only option to get money for the fee was to sell poultry. The rice harvests were small and not even enough to feed the families the whole year, let alone to sell it in the market. In long run the selling of livestock can threaten food security in the area.

In Champasak province, where the case study villages were closer to roads and services, the situation was somewhat different. There the electricity could be used for income generation, at least in one village where brooms were made in the evenings in the electricity light and sold in the market near Thailand border. This village was in generally wealthier and there was enough rice for practically all the year. 75% of the households used solar electricity not only for light and stereos but also for TV. In other villages in the same province the panels had stopped working after seven years. “The light does not last even as long as [it takes to chew] betel nut (i.e. about one hour)”, commented an old woman. People were angry because they felt that they had been misled by the promoters who had said that the panels would work for 50 years. The commitment for 10-year payment scheme didn’t sound too bad if the panels would still work for another 40 years. It had also been surprise at the beginning that they have to pay for new batteries.

However, even in the villages which were better off and the off-grid program was working well, it is questionable whether the solar panel program was able to alleviate poverty. When the system was working well, the users were usually happy about the program: it was convenient to use – just switch on the light – and it reduced smoke in the houses. Electricity also brought a sense of modernity that the panel users appreciated. Some of the responses of the benefits seemed however to repeat the sentences of the solar panel program promotion as practically all respondents mentioned that the electricity was good because kids could study at night – even though there was no books, no teacher available, and the school building had crumbled down years ago.

5. Discussion and Conclusions

Goldman (2005, 57) observed more than five years ago that World Bank has been successful in converting the criticism from environmentalists that was threatening its position as one of the global leaders into a globally adopted green agenda that works in its favour. In the energy sector heavy criticism on Bank’s funding on fossil fuels, not only from civil society but also from several governments¹ has in-deed led the World Bank to present itself as a pro-renewables institution. The greener the Banks

program. The base camp got its electricity from the solar panels. People living in the nearby villages saw how they worked and requested the panels. Two years later, in 2008, 50 households in the village cluster Thai Phai Ban. The panels were installed under special arrangements and the households that received them – mainly village heads’ relatives and other elites of the area – and the households did not pay for the installation, only monthly fee. Later more solar panels were installed. This time there were no special arrangements and the installation followed the usual off-grid program procedure which meant that the end-users had to pay for both installation fee and the monthly fee.

¹ Extractive Industries Review was one example of this. More recently e.g. in the case of the \$3.75 billion loan for the South African Medupi Station governments of United States, Britain, the Netherlands and Italy actually abstained to vote on the approval of the loan (Ecopolitology 2010).

has become in discourse level the more there has been discussion on whether the rhetoric really matches with reality. In the energy sector World Bank has created problematic counting techniques of its renewable funding. So far there has definitely been some progress but not necessarily in revolutionary scale.

The case of Laos is illustrative for the two important trends in World Bank's renewable energy finance: the return of the large-scale hydropower and funds for solar home systems. In Laos the renewable revolution seem not to be too different from the energy plans World Bank and Asian Development Bank have promoted for the Mekong Region since the beginning of 1990's in which Laos through a regional electricity grid serves hydropower energy for its neighbours. Only now Laos is not presented as the battery but as the green battery of the region. The new frames for large-scale hydropower have not, however, solved the "old" problems in relation to poverty alleviation. The Nam Theun 2 hydropower dam, discussed in this paper, has been an important demonstration case for World Bank that hydropower can be built in environmentally and socially sustainable manner but there seems not to be clear success in achieving this. There are still many unanswered questions for example related to the sustainability of livelihoods in resettled villages and affected communities downstream along the Xe Bang Fai River as well as to the reliability of the government's revenues distributed in a manner that could alleviate poverty. Also the climate-friendliness of the dam is not proven because there are not yet any calculations made public on the green house gases produced by the reservoir.

In the rural electrification of Laos the main target still is to extend the national grid, with significant support from World Bank and Asian Development Bank, the main power producers being large-scale hydropower plants. The priority that is given to large-scale hydropower thus leaves only a marginal space for smaller-scale solutions to foster. So even though World Bank is also supporting decentralized small-scale renewable technologies these have mostly been considered serving as transition technologies. Thus steps towards truly revolutionary road in renewable energy are yet to be taken.

Through the study of the World Bank's off-grid rural electrification program we have also observed that the choice of technology and implementation model of the program have been problematic. The program has been dominated by solar home systems which are relatively expensive and high-tech solutions. The rationale behind the priority given to this model has more to do with its universal applicability and easiness for the funder rather than local appropriateness. The more locally driven solutions such as pico-hydro, have been so far over-looked by the donors and the government. The panels have been said to last several decades but according to the field observations and interviews many panels started to be dysfunctional already after 6-7 years. In the interviews conducted the World Bank, Ministry of Energy and Mines of Laos, and the implementing organisation, Village Off-Grid Program (VOPS) all see the solar program as a success story, even though - as we have showed many technical, institutional and economic problems remain.

The use of decentralized renewable energy technologies in rural electrification has been experimented and used for several decades now, but still there have to often been duplications of inefficient policies (Green 2004). As development banks are now taking up the task of fostering renewable energy they would need to seriously weigh the long term impacts of different renewable energy options and aim at learning faster what works and what doesn't.

In both cases also the synergies with poverty alleviation objective seem to be problematic. The problems related to large-scale dams were already highlighted above. But also the solar home systems

seemed not to be contributing very clearly to poverty reduction. There seemed to be quite narrow possibilities to increase income generation through the activities that the lighting enabled. For the poorest families in remote areas the payment for the system had created a new burden and some were selling very basic assets like small livestock in order to pay for the panel and for the new electric devices (cd-player or television) that the panel enabled. In some of the most remote villages even if the children for example in theory could study now more in the night time they did not even have school were they could have gone in the day time. People anyway seemed to appreciate the sense of modernity the panels brought but the poverty alleviation aspect was not clearly achieved. These kinds of cases make it fair to ask whether the solar home systems are money well spent, or would other development initiatives provide better results in poverty reduction.

Despite questionable relationship between rural electricity provision and an increase in productivity leading to higher income, World Bank seems to be inclined to highlight the win-win storylines in its policy documents. As the interests of donors including development banks and national development agencies to allocate development finance to climate change mitigation projects are increasing there is a need to discuss more critically the synergy potentials of the twin objective of mitigation and poverty alleviation. Our findings seem to be in line with previous studies (e.g. Michaelowa & Michaelowa 2007, Gupta 2009) that have pointed out that the contribution of emissions mitigation projects to Millennium Development Goals is often quite limited and other project types are likely to be much more effective. These findings also speak on behalf of the importance of having truly additional finance for climate actions. This is the case especially in Least Developed Countries such as Laos. This of course does not mean that there would not be a need to change the current development and energy paradigm (see also Gupta 2009, Brooks et al. 2009, Boyd & Juhola 2009). Quite the contrary. But World Bank and other dominant actors in energy and development field seem to still lack clear evidence of having taking the task of fostering an environmentally and socially just energy future.

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DEVELOPING TIBET INTO A SPECIAL SUSTAINABILITY ZONE OF CHINA?

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ABSTRACT – China has developed many Special Economic Zones (SEZs), such as Shenzhen, Xiamen, Shantou and Zhuhai, and several countries (e.g. Brazil, India, Pakistan, South Korea, North Korea and Russia) have followed its example. China could also take a lead in developing Special Sustainability Zones (SSZs). Sustainability integrates economic, social, cultural and environmental sustainability. China is already experimenting the integration of economic and environmental sustainability in Jilin where a Low Carbon Zone (LCZ) is piloted. Becoming one of the world's superpowers China needs to address also the social and cultural aspects of sustainability in addition to its economic and environmental aspects. What could be a better place to start than Tibet, the focus of global interest and yardstick of China's willingness to cooperate internationally? Turning Tibet into a Special Sustainability Zone would enable meeting China's and Tibetan people's needs simultaneously: (1) physiological needs: water, food and energy; (2) safety needs: sovereignty and peace; (3) social needs: good relations and cooperation with others; (4) esteem needs: respect by/of others; (5) self-actualization needs: morality and creativity; and (6) self-transcendence needs: united consciousness. This paper drafts a plan for developing Tibet into a Special Sustainability Zone, which also attempts to ease the politically charged situation.

1. Introduction

Special Economic Zones

During the 1980s China developed many Special Economic Zones (SEZs): the cities of Shenzhen, Xiamen, Shantou and Zhuhai, and the Hainan Province. The SEZs were established as testing grounds for the development of China's economic system (Park 1997). They have been based on market economy long before China adopted it in the whole country. SEZs offer tax incentives for foreign investments and give independence for international trade (Park 1997). They host both foreign companies and joint ventures between Chinese and foreign companies, which focus on exports. The experiences of SEZs have been so positive that China has gradually implemented their principles in other areas as well. Several countries, such as Brazil, India, Pakistan, South Korea, North Korea and Russia have followed China's example and developed their own SEZs.

China could also take a lead in developing Special Sustainability Zones (SSZs) to test a new, holistic system for the 21st century. The SSZs will integrate environmental, economic, social and cultural sustainability.

Justifications for Special Sustainability Zones

There appears an increasing number of “Special *Unsustainability Zones*”, areas where economic development is so rapid and unstable that it causes severe environmental, social and cultural problems. An example of this is the city of Zhongdian in the Tibetan Autonomous Prefecture in the Yunnan Province of China. In 2001 Zhongdian, with its splendid mountain views, was allowed to change its name into Shangri-La, i.e. the name of the utopian lost Garden of Eden at the root of Tibetan mountains described in James Hilton’s (1933) book *Lost Horizon*. Tourists are now pouring there: in 2009 over 2 million tourists visited Shangri-La while in 2000 only about 20,000 tourists visited Zhongdian (Poropudas 2010). Shangri-La is growing very rapidly – and unsustainably: it suffers from serious water shortage and irresponsible building; most people in the region have moved or been resettled from countryside to the city, only the old stay; and the traditional Tibetan culture disappears. Near Shangri-La is located one of China’s most popular tourist destinations, the Old Town of Lijiang, which represents the traditional architecture, history and culture of the Nahki people. The town nearly lost its UNESCO World Cultural Heritage Site status because of massive new construction activities that threatened to overpower its cultural treasures.

Economic growth and commercial success are threats to traditional cultures and cause conflicts between Han Chinese immigrants and local native minority groups. The Han Chinese as well as the central and regional governments aim at economic growth, which, in their opinion brings development and prosperity to the nomadic and agricultural areas of the indigenous peoples. It seems, however, that most of the economic and social gains go to the Han Chinese and not to the original inhabitants who only wish to maintain their traditional livelihoods and cultures.

China is already experimenting the integration of economic and environmental sustainability in Jilin where a Low Carbon Zone (LCZ) is piloted as a joint research project between Chatham House, Chinese Academy of Social Sciences, Energy Research Institute, Jilin University and E3G (Chatham House 2010). Becoming one of the world’s superpowers China needs to address also the social and cultural aspects of sustainability in addition to the economic and environmental aspects.

Obstacles to Special Sustainability Zones

Establishing Special Sustainability Zones (SSZs) in minority regions may face some obstacles. The 1,230 million Han Chinese account for 91.51 % of China’s population. While there are 55 minority groups in China – Zhuang (16 million), Manchu (10 million), Hui (9 million), Miao (8 million), Uyghu (7 million), Yi (8 m), Tujia (6 million), Mongols (6 million), Tibetans (6 million), etc. – they account for such a small proportion of the population that their voices are not heard, particularly as China’s aim has been a mono-cultural nation. There is only one official language, Mandarin Chinese, which is the language of education and authorities. The Central Government has supported large population transfers of Han Chinese to minority regions. The Han Chinese tend to think that minorities in their traditional costumes

are just a curiosity for festivals and tourists (Poropudas 2010). There is a general view among Han Chinese that minorities are well looked after: the Central Government gives minority areas economic development aid (most do not know that the aid goes mainly to the immigrated Han Chinese), and minorities need fewer points to be accepted to good schools and universities (which has prompted many Chinese to gain a minority status for the duration of studies). Why should the minorities then be given Special Sustainability Zone statuses? The SSZs are not only for minority areas but for any area that is interested in it. Unlike most Han Chinese, minority peoples often prioritize the social, cultural and environmental sustainability of their area to rapid economic growth, which makes them willing participants in SSZ projects.

New Idea: Special Sustainability Zones (SSZs)

Rapid economic development has made millions of people wealthier, but also increased polarisation between the rich and the poor, damaged the natural environment on which future material and immaterial wellbeing depends on, caused new health problems while solving old ones, and eradicated traditions that have kept up sustainable living and elevated spirits of people.

There are areas and peoples who do not want rapid economic growth but balanced sustainable development. Many minorities wish balanced environmentally, economically, socially and culturally sustainable development in their regions. It is well China's worth to help them fulfil their wishes because holistic sustainable development maintains natural resources, improves livelihoods, preserves traditions and makes people healthier and happier. Holistic sustainable development restores and upholds peace.

The different dimensions of sustainability can be defined in the following way (Ketola 2010). Environmental sustainability can be achieved by staying within the limits of the carrying capacity of the ecosystems, and by revitalizing the ecosystems through protecting their biodiversity and their life-support systems. Socio-cultural sustainability can be attained by staying within the limits of the carrying capacity of humans and cultures, and by revitalizing human and cultural diversity and their life-support systems. Economic sustainability can be achieved by staying within the limits of the financial resources and global, regional and local legal and ethical norms and revitalize both of them through innovation and collaboration, so that environmentally and socio-culturally good life can be supported both now and in the future. A Special Sustainability Zone (SSZ) aims at environmentally, economically, socially and culturally sustainable development.

2. Developing Tibet into a Special Sustainability Zone (SSZ) of China

Tibet

What could be a better place to start the development of Special Sustainability Zones (SSZs) than Tibet, the focus of global interest and yardstick of China's willingness to take environmental, social and cultural sustainability seriously and to cooperate internationally in achieving them? The SSZ status could also ease the politically charged situation in Tibet. Turning Tibet into a Special Sustainability Zone of China would enable meeting both China's and Tibetan people's needs simultaneously: (1) physiological needs:

water, food and energy; (2) safety needs: sovereignty and peace; (3) social needs: good relations and cooperation with others; (4) esteem needs: respect by/of others; (5) self-actualization needs: morality and creativity; and (6) self-transcendence needs: united consciousness. This paper drafts a plan for developing Tibet into a Special Sustainability Zone, which attempts to ease the politically charged situation.

Tibet is a 2.5-million km² plateau region north of the Himalayas. It is a huge area, 2/3 of the size of India (DIIR 2008). As the highest region on earth it is called the “roof of the world”. Tibet lies north of India, Nepal, Bhutan and Burma, and west of China. It emerged as an independent empire in the 7th century, but over the centuries it often fell under Mongolian or Chinese rule. The British have also had political interests in Tibet. Yet in 1914, Britain, China and Tibet signed a peace convention, which recognized Tibet again as an independent country. From 1914 to 1949 Tibet enjoyed its independence. In 1949 China invaded Tibet, but in 1951 China and Tibet, led by the 14th Dalai Lama, signed the Seventeen Point Agreement for the Peaceful Liberation of Tibet, which affirmed Tibet’s autonomy under China (China.org.cn 2011, DIIR 2001, Lhasa 2011). However, China did not ratify the agreement, and in 1959 China abolished the Tibetan government led by the Dalai Lama, who fled to India and set up an exile government in Dharamsala. The Dalai Lama’s exile government has over the decades tried to negotiate with the Chinese government on the return of autonomy to Tibet. In 1987 the Dalai Lama presented a Five Point Peace Plan (Dalai Lama 1987), which was not accepted by the Chinese government.

Tibet is a traditional homeland of nearly 6 million Tibetans led by the Dalai Lamas since 1391. In 2011 the 14th Dalai Lama decided to retire from his political role and continue only as a spiritual leader. Dr. Lobsang Sanga, a Harvard Law School academic, was elected a new Kalon Tripa (Prime Minister) by the Tibetans in exile. He now leads the Central Tibetan Administration (CTA) in Dharamsala. There are about 150,000–300,000 Tibetans living in exile, mostly in India, but also e.g. in Nepal, Bhutan, the USA and Canada. About 5.4 million Tibetans live on the plateaus of Tibet. China has divided Tibet between different administrative areas: the Tibet Autonomous Region, Qinghai Province, two Tibetan Autonomous Prefectures and one Tibetan Autonomous County in Sichuan Province, one Tibetan Autonomous Prefecture and one Tibetan Autonomous County in Gansu Province and one Tibetan Autonomous Prefecture in Yunnan Province. China calls Tibet only the 1.2 million km² Tibet Autonomous Region (TAR) with 2.9 million Tibetans and large numbers of immigrated Han and Hun Chinese. The new Chairman of the TAR since 2010 is Padma Choling, who is ethnic Tibetan, member of the Communist Party of China and former soldier of the People’s Liberation Army. Hence the political situation is complex with the TAR, Qinghai, Sichuan, Gansu and Yunnan provinces involved in China and the CTA in India.

The CTA under the Dalai Lama negotiated on the possible political solution with the Central Government of China. In order to establish a Special Sustainability Zone (SSZ) in Tibet, negotiations both with the Central Government and with the TAR and Qinghai, Sichuan, Gansu and Yunnan provinces will be needed to form a unified SSZ of Tibet. The Central Government of China has the power to re-integrate Tibet into a SSZ, but regional leaders can contribute to this favourable process and help the CTA in its implementation. All these participants can take pride in playing a major role in this pioneering endeavour.

Environmental sustainability

Environmental sustainability is the foundation for economic, social and cultural sustainability because humans with their economic, social and cultural systems cannot survive without a sustainable natural environment. The most critical environmental sustainability issues in Tibet are (a) climate change, (b) mining impacts, (c) deforestation, (d) decreasing biodiversity, (e) hydroelectric building impacts and (f) nuclear waste.

(a) Global *climate change* has reached also the “roof of the world”. The Intergovernmental Panel on Climate Change (IPCC 2007) analyzes Tibet as one entity because the Tibetan plateau covers almost two per cent of the total land area of earth and extends from four to eight kilometres above the sea level. Consequently, the Tibetan plateau has major environmental impacts on Asia and the North Pacific. According to the former head of the China Meteorological Administration: "Temperatures are rising four times faster than elsewhere in China, and the Tibetan glaciers are retreating at a higher speed than in any other part of the world" (Qin 2009).

The anthropogenic (manmade) climate change results from the industrial activities mostly outside Tibet, but local mining and construction are exacerbating the effects. China has overtaken the USA as the world's largest carbon dioxide (CO₂) emitter. Tibet has had very little industry or traffic until recently, but Tibetans, just as well as Chinese and other Asians, suffer from the consequences of climate change.

Tibet with its 105,000 km² of glaciers is most glaciated region on earth but its glaciers are melting fast, which first leads to floods, landslides and glacial lake outbursts, but in the long run results in loss of water flow to the lowlands of Asia and droughts (Qin 2009). Rivers originating in Tibet sustain the lives of 85 percent of Asia's total population, which accounts for 47 per cent of the world's population. Tibet is the source of dozens of major rivers such as the Brahmaputra, Indus, Mekong, Yangtze and Yellow Rivers, running through China, India, Pakistan, Nepal, Bhutan, Bangladesh, Burma, Thailand, Vietnam, Laos and Cambodia. If the rivers stop flowing, these countries will face deforestation, desertification and soil erosion leading to massive water shortage, loss of agricultural land and domestic animals, escalating diseases, famine and starvation of billions of people, and death of billions of wild animals and plants. In Tibet the lakes and wetlands acting as carbon sinks are already drying, thereby turning into carbon emitters, and desiccation and desertification are advancing rapidly (DIIR 2009).

There is little humans can do to stop climate change any more, and international attempts to mitigate it are dwarfed by economic competition between nations and between corporations. The problem is negotiated regularly at the UN climate change conferences. At such a conference in Copenhagen in December 2009 China announced its goal to reduce its CO₂ emissions by 40–45% compared to 2005 level by the year 2020. That is a start, but not a final solution.

(b) *Mining impacts* are a major local and regional environmental problem in Tibet. The opening of the Qinghai-Tibet railway in 2006 opened also large-scale exploitation of Tibet's rich mineral resources for the state-owned Chinese and international, particularly Canadian, corporations. Tibet has 126 different minerals of which gold, chromate, copper, zinc, lead, borax and uranium are currently heavily mined. Also the prospects for the mining of lithium, boron, iron ore and oil are excellent. The mineral reserves have an estimated value of US\$128 billion (Spero News 2007). They are spread over more than 600 sites on the Tibetan plateau and could not be exploited without the railway. Both global and Chinese demand for minerals is great because of the exhausted mines in other parts of the world and the swift

industrial development of China and other fast developing economies. With the Tibetan deposits China has doubled e.g. its copper, zinc, and lead reserves and does not need to import many of the minerals from abroad any more.

The mining corporations have not paid attention to the environmental or social impacts of mining and transportation, thereby causing serious damage to the nature and people of Tibet. Mines destroy natural environment with its flora and fauna. Mining forces some local communities to be relocated, ruins the grazing and agricultural lands of others and kills their livestock with its toxic substances released in the local environment (Fan 2009). For example, arsenic released during extraction causes poisoning of groundwater. Humans and animals in many villages have become very ill and died of arsenic poisoning. Contamination of the rivers affects thousands of people and animals locally and hundreds of millions downstream. The toxic substances of mining are a serious health hazard to both the current generation and the future generations as they inflict the human genes. Chinese officials have said that their policy is that they do not approve such mining operations in Tibet that would damage its environment and that mining companies will have to pay for any damage they cause, but it is unclear how this policy is implemented in the current mining boom in Tibet (Bristow 2007).

For the Chinese mining is an economic activity with some environmental impacts to deal with, but for the Tibetans mining integrates economic, environmental social and cultural unsustainability: mining companies conquer ecologically fragile mountain ecosystems that have spiritual meanings in Tibetan culture, and mining obliterates traditional nomadic and agricultural livelihoods, leaving the Tibetans without proper compensation from the huge profits the companies make and deprived of the economic and social welfare mining brings to the Han Chinese.

(c) *Deforestation* has been rampant in Tibet during the past 50 years. In 1959, Tibet's forests covered 25.2 million hectares; by 1985 half of these ancient forests had been clear-felled and transported to China (CTA 2009). The authorities of China estimate that up to 80 percent of the forests in Tibet have now been destroyed. Deforestation causes erosion, landslides and degradation of the soil, which are exacerbated by the fact that forests in Tibet grow on steep slopes in river valleys. Due to uncontrolled deforestation rivers are very silted, which causes flooding downstream also in other Asian countries. The President of China blamed the uncontrolled deforestation of the Tibetan Plateau for the Yangtze flood in 1998 that caused the deaths of 4,150 people, evacuation of 18.4 million people and economic losses of US\$37 billion (Wang and Guo 2010). This was a partial wake-up call: logging was banned in some areas and some reforestation projects were initiated (Hays 2010). The reason for frequent floods devastating Bangladesh can also be found in the deforestation of Tibet. Moreover, the environment of Tibet affects the monsoon rains of South Asia, Pacific typhoons and El Nino.

(d) *Hydroelectric building* on the rivers originated in Tibet is in full swing by Chinese companies (Moore 2008). In addition to electricity production, some dams may be built also to divert river waters to vast areas of China that are suffering from water shortage (Buckley 2007). Both these purposes have major malignant environmental impacts on Tibetans as well as on Chinese and other Asians living downstream these rivers. The Tibetans do not have any need for dams: they have minor water and energy needs that they can satisfy by using natural waters and solar energy. Chinese companies produce hydroelectricity in Tibet for the immigrated Chinese and for exports to Chinese cities (Buckley 2007).

Usually dam projects block the course of a river and form a reservoir behind the dam wall, which is drained through turbines to produce electricity. This leads to loss of forests, agricultural land, villages

and towns under the reservoir. However, the environmental impacts of the largest hydroelectric project in Tibet, the Yamdrok Lake hydroelectric station about 100 km southwest of Lhasa, are even worse. This power station drains a natural lake by placing the turbines in tunnels drilled into the mountainsides surrounding the lake. "The fragile balance of the lake's ecology is severely threatened by the unnatural interference with the lake's water flow and with it the livelihood of the local people as well as the wildlife that flourishes around this lake. Migrating waterfowl, which rely on the lake's rich food resources to sustain them on the difficult journey across the Tibetan plateau and the world's highest mountains – the Himalayas – are particularly threatened" (TSG 1996: 1). Due to this power plant construction the Tibetans living in the area lost 16 per cent of their agricultural land. The construction drained the water springs in the area in 1993 and the villagers were forced to drink the lake water, which caused them diarrhoea, loss of hair and skin diseases. The whole lake will dry up within 20 years. If water from the Yarlung River is pumped into the lake to maintain its water balance, "the different limnological properties of the two water bodies are likely to cause environmental problems" (Seibert and Stockman 1997: 25). Up to 15,000 soldiers of the People's Liberation Army now guard the lake, denying the access of civilians there any more (Moore 2008). What used to be a peaceful, flourishing lake ecosystem with a spiritual meaning to Tibetans is now a military zone destroying the lake for electricity.

Another hydroelectric plant near Lhasa is the Zhikong dam in Lhasa River, which was put into operation in 2007. During 2000-2008 the Central Government of China invested US\$395 million in hydropower construction in Tibet (Moore 2008). Now China is planning to build 750 more hydroelectric power plants across Tibet. For the Longtan hydropower station in the Hongshui River over 80,000 Tibetans were relocated. The Zangmu Dam is under construction on the Yarlung Zangbo/Brahmaputra River in Tibet to be opened for hydropower production in 2015 (Yannan and Haining 2011). It has caused controversy downstream in India, where people wonder if the river's flow to India decreases either because of electricity production or because of China's plans to divert the flow of the river to its own areas. In the Mekong River China is planning eight dams, which will destroy the river and devastate the livelihoods of 60 million people, mostly farmers and fishermen depending on the river, at the Mekong basin in Vietnam, Cambodia, Laos, Thailand and Burma.

(e) *Nuclear waste* is dumped in Tibet. Because of Tibet's strategic location, China has brought some half a million soldiers and nearly 25 per cent of its nuclear missiles to Tibet. China is also using the Tibetan plateau as dumping ground for its own and foreign nuclear waste. There are reports of increased deaths, cancer rates and birth defects among Tibetan people and their livestock as well as contamination of waterways near nuclear sites (CTA 2009).

(f) *Decreasing biodiversity* caused by climate change, mining, deforestation, hydroelectric building, nuclear waste dumping and hunting is a serious concern in Tibet, which is a home of hundreds of thousands of animal and plant species, many of which are rare and endangered. There are over 100,000 species of plants in Tibet, including rhododendron, saffron, bottle-brush tree, high mountain rhubarb, Himalayan alpine serratula, falconer tree and hellebonne (CTA 2009). More than 532 species of birds can be found in Tibet, e.g. black-necked cranes, storks, wild swans, Blyth's kingfishers, grey-sided thrushes, Przewalski's parrotbills and large-billed bush warblers (CTA 2009). A vast range of rare animals threatened with extinction include the snow leopard, Tibetan takin, Himalayan black bear, wild yak, blue sheep, musk deer, golden monkey, wild ass, Tibetan gazelle, Himalayan mouse hare, Tibetan antelope, giant panda and red panda (CTA 2009). Trophy hunting is common in Tibet (People's Daily

2002) and China sells hunting licences to foreign tourists for rare animals: e.g. wild yak US\$40,000, argali US\$10,000, red deer US\$6,000, blue sheep US\$2,500 and wolf US\$200 (Watts 2006). Moreover, rare animals are poached commercially for fur (e.g. snow leopard), Chinese medicine (e.g. deer) and meat (e.g. antelope, gazelle, blue sheep and wild yak) for Chinese and European markets (CTA 2009).

(a–f) Tibet has become a bottomless pit of *natural resource exploitation* for mining, logging, oil, electricity, nuclear waste, and hunting companies. This should be stopped now. Otherwise we all are responsible for wiping out Tibet's unique flora and fauna and obliterating its beautiful nature, the ecosystems of which are still keeping 47 per cent of the world's population alive. This fragile Tibetan plateau is our lungs, our heart and our veins. China has had environmental policies for Tibet for 60 years (Wu 2011), but they have not worked. Saving Tibet requires not only seamless cooperation between the CTA and the central and regional governments of China, but the full efforts of the global community. The problems are caused by us all and we can solve them together.

The most sensible way forward is turning Tibet into a *Special Sustainability Zone* (SSZ). The very first goal of this SSZ should be the *rescue of Tibet from the otherwise inevitable environmental disaster*. There is general agreement on the environmental problems that must be tackled in Tibet. Other issues can be added gradually, as this environmental cooperation increases understanding between the participants. Many of the environmental sustainability issues overlap social sustainability issues, which can be tackled once the participants learn to understand their interconnections and appreciate each other's concerns.

Social sustainability

Subsistence agriculture and animal husbandry are dominant livelihoods on the Tibetan Plateau. China calculates statistics relevant to Tibetans only in the Tibet Autonomous Region (TAR). Of the reported TAR's 2.9 million population 80 per cent are farmers and herders (ShowChina.org 2011). According to China Daily (2011), the net income of farmers and herders in the TAR was 3,176 yuan in 2008 while the urban per capita disposable income was 12,482 yuan. The income gap between Tibetan farmers/herders and Han Chinese population is probably even greater and applies to all provinces on the Tibetan Plateau.

During the past decades the Central Government of China has been resettling traditionally nomadic Tibetan farmers and herders into permanent houses not only in the TAR but also in the other provinces. China has recently stepped up this resettlement: in 2008 alone it moved 300,000 Tibetans (China Xinhua News Agency 2008). By 2010 about 80 per cent of Tibetan farmers and herders had been resettled. The Government says this will help to protect the environment (the grasslands) and boost living standards. But from the nomads' point of view resettling involves slaughter of the animals, relocation to poorly built accommodation and inability to find work due to lack of skills (HRW 2007). Nor does resettling lead to environmental protection, as the genuine nomadic way of life does not consume the environment: nomads live in harmony with nature.

The degradation of grasslands is caused by the agricultural, industrial and settlement policies of Central Government of China, which led to the conversion of Tibetan grassland to cropland in the early 1950s, cultivation of mono-crops like rapeseed, privatization of the traditional communal pastures of nomads to allow commercial development, elimination of predators that balance the ecosystem, uncontrolled mining and harvesting of wild herbs for medicines, infrastructure development (highways,

railways, airports and townships for Han Chinese immigrants and resettlers), fencing and permanent settlement, and mountain closures from Tibetans and their livestock. Restrictions on the flexibility and mobility of nomads have led to the concentration of herds in small areas of pasture, which quickly become overgrazed (DIIR 2008). Naturally, there is also a feedback loop between overgrazing in limited areas and climate change: “degradation of grassland by overgrazing will increase potential evapotranspiration level thereby promoting the climate warming and the degradation process” (Du *et al.* 2004: 241).

The traditional nomadic livestock management system in Tibet was “a time-tested model, sophisticated, and developed enough to ensure viable and sustainable management of marginal pastures” (Goldstein 1990). Now that we have learnt from past mistakes all over the world we can return to the traditional sustainable ways of life. On the Tibetan Plateau this means nomadic, communal herding. China’s poverty reduction and safe drinking water projects in Tibet (ShowChina.org 2011) can be integrated into this suggested voluntary re-nomadization project by turning nomadic herding into an esteemed profession that requires both traditional and modern skills and leads to economically sustainable livelihood, and by preventing mining in grazing areas and in otherwise ecologically fragile areas and imposing strict environmental standards on the mining companies to prevent the contamination of the lakes and rivers of the Tibetan Plateau.

The joint implementation of these socially sustainable development projects will also help the central and regional governments of China and the CTA find common ground in respecting the rights of Tibetan people to live the way they wish. China has signed the threefold International Bill of Human Rights: it has signed and ratified the Universal Declaration of Human Rights and the International Covenant on Economic, Social and Cultural Rights, and it has signed but not ratified the International Covenant on Civil and Political Rights. Let’s start with the ratified agreements.

Cultural sustainability

Culture is much more than traditional costumes and festivals. culture is a set of distinctive spiritual, material, intellectual and emotional features of society or a social group, and it encompasses lifestyles, ways of living together, value systems, traditions, beliefs, languages, art and literature (Pirnes 2007). Tibetan culture is distinguishable because of the remoteness of the area has preserved it well from international influences. Nomadic, communal way of life has been an essential part of Tibetan culture. Tibetan cuisine reflects the traditional livelihoods of animal husbandry and subsistence farming. Buddhism has always been a strong element of Tibetan culture – and Tibetan Buddhism is a distinct branch of Buddhism with its dogmas, rituals and monasteries. From 1391 until June 2011 the Dalai Lama was both the political and spiritual leader of Tibet; from then on only the spiritual leader, as the political leadership was transferred to the Kalon Tripa (Prime Minister) of the Central Tibetan Administration (CTA). Only time will tell what the separation of political leadership and spiritual leaderships means in practice. Tibetan art and architecture are deeply influenced by the Buddhism. Tibetan music, drama and festivals draw from history and religion. Most Tibetans wear traditional clothes in everyday life. There are several Tibetan languages, but Central Tibetan, based on the speech of the capital, Lhasa, is used most widely. Primary education is usually given in Tibetan, but from secondary school onwards education is in Mandarin Chinese, which makes written Tibetan wither.

Ancient Tibetan literature is abundant for both lay and religious purposes, but modern literature is scant. Illiteracy is common among adults in rural areas. The CTA runs Tibetan schools in Dharamsala, where Tibetan and English are the languages of education. Tibetan culture is best preserved and cherished when traditional Tibetan way of life with postmodern conveniences can be promoted.

Economic sustainability

During the past 60 years the Central Government of China has aimed to develop the Tibetan areas of China through its five-year programmes in the same way as other areas. This kind of economic development has been modelled on the unsustainable path that the European, American and Asian countries have followed. This has meant prioritizing economic growth over environmental protection, social harmony and cultural traditions. Single-track pursuit for maximum profits has led to widespread corruption also in Tibet. Yet it is not necessary to sacrifice environmentally, socially and culturally sustainable development on the shrine of economic prosperity.

Integrating environmental, social, cultural and economic sustainability

Now it is possible for countries and areas to bypass the conventional development model and go straight to the new, emerging models that lead to integrated economically, environmentally, socially and culturally sustainable development. Countries and areas can choose to aim at (1) wellbeing instead of welfare; (2) maximization of gross national happiness instead of gross national product; (3) decentralized renewable energies, such as solar and wind power, instead of centralized energies, such as oil, coal and hydropower; (4) traditional livelihoods like nomadic herding, organic farming and craftsmanship instead of industrial livelihoods like mining, construction and logging; (5) human-powered, animal-powered and solar- or wind-powered vehicles instead of fossil-fuel powered vehicles; (6) modern, light tools like solar-powered laptops & mobile phones and eco-toilets instead of ignorance and water closets; (7) education that sustains indigenous languages and traditional cultures instead of abolishing them; and (8) peaceful, harmonious, spiritual life instead of conflict-ridden, hectic, materialistic living. Special Sustainability Zones (SSZs) can be testing grounds for this new path.

Tibet with its indigenous people's feet firmly on the ground of the Tibetan Plateau and hearts deeply in the beliefs of Tibetan Buddhism is an excellent candidate for a SSZ. Tibetans have always believed in the interdependence of living and non-living elements of the earth and sought to live in harmony with nature. Tibetans are the ones to decide how they use their natural resources. They can set codes of conduct for themselves, companies and visitors. Tibetans are satisfied with moderation: the environment should be used to fulfil one's need and not to fulfil one's greed (DIIR 2008). This is a fertile soil to plant the seed of a Special Sustainability Zone.

3. Conclusions (reduced due to space limitations)

A Special Sustainability Zone (SSZ) integrates economic, environmental, social and cultural sustainability. Turning Tibet into a SSZ would enable meeting China's and Tibetan people's needs simultaneously: (1) physiological needs: water, food and energy; (2) safety needs: sovereignty and peace;

(3) social needs: good relations and cooperation with others; (4) esteem needs: respect by/of others; (5) self-actualization needs: morality and creativity; and (6) self-transcendence needs: united consciousness.

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COPENHAGEN FAILURE AND NORTH-SOUTH DYNAMICS

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1. Introduction

This study is a rhetorical-philosophical analysis of select Copenhagen Climate Convention public speeches. I chose the most important speeches covering different kind of participants from major to minor economies, from developed to developing countries and from statesmen to organization representatives. In this paper, the concept of North refers to UNFCCC's so-called Annex I group (developed nations) while South refers to non-Annex I countries (developing nations).

When I chose the speeches, the most important criterion was to get material that covered both wealthy and poor nations (North and South) and those in the transitional stage. For these reasons the United States (Barack Obama), the African Union (Meles Zenawi) and China (Jiabao Wen) were natural choices. As the African Union represents a group of nations from South (a unit representing a compromised interest of its members), I decided to include an example of a smaller South negotiator to get material that may accentuate "the voice of South": Zimbabwe (Robert Mugabe) is a very minor negotiator, but for that very reason, its rhetoric is very illuminating for this analysis. To balance this with another voice from North, Tony Blair was an interesting choice because of his dual linkage, as he represented his own non-governmental organisation (The Office of Tony Blair) but has been politically associated with the Great Britain in the media.

This paper aims at answering the following questions:

What sort of North-South dynamics can be revealed from the chosen Copenhagen Climate Convention's speeches? How is the possibility for "crossing the North-South gap" enhanced or impaired in the speeches?

Thus far, studies of climate rhetoric have been rather scarce, while ethical questions have dominated philosophical climate change discussions. Rhetoric studies can help reveal closed discourses and to explicate them. Further understanding of rhetoric could help illuminate the problems of the public environmental discourse, while also giving ideas of how to enhance it (Bruner & Oelschlaeger 2008, 216-221). These revelations may also benefit the social sciences by approaching climate change from other perspectives: rhetorical studies, for example, illustrate the prevailing conceptions of ethical concepts and enlighten the dynamics and relations between different participants.

Identification

Rhetorical analyses may involve many perspectives, but the one I chose as especially interesting in this context concerns the identification thesis of Kenneth Burke. In one of his main works, *A Rhetoric of Motives*, Burke focuses on the concepts of identification and persuasion. Burke suggests that identification is the most central concept in rhetoric and a prerequisite for successful persuasion (Burke 1969, xiii). The identificational viewpoint involves focusing on the ways people rhetorically group/conceive themselves and the others. It helps us to see whether the voices of North and South form their own separate groups or attempt to “open themselves”, cross the barrier and form a “global we” to act despite the afflictive inequality issues and differing worldviews.

Burke's concept of 'identification' can be described as follows: "A is not identical with his colleague, B. But insofar as their interests are joined, A is identified with B. Or he may identify himself with B even when their interests are not joined, if he assumes that they are, or is persuaded to believe so." (Burke 1969, 20.) The audience's identification with the speaker means that the audience not only receives but also participates in the assertions which leads to collaborative feelings (Burke 1969, 57-58.). This is the most important point for the negotiational context: the feeling of collaboration enhances the possibilities for real teamwork between negotiators and for successful results.

In international climate negotiations, there are two main types of identification that can take place between negotiators. Barrier-crossing identification occurs when the North and South seem to overcome their differences and acknowledge, or partially acknowledge, their shared interests or attitudes: this identification is crucial for successful results. The counterpart is the barrier-blocking identification, which takes place inside either North or South, excluding “the other side”. Barrier-blocking identification occurs also when the speaker is identified only with his own nation or continent. Barrier-blocking identification is not beneficial for successful agreements or negotiations; it may even diminish the possibilities.

Division is identification's natural counterpart (Burke 1969, 22-23). It has been often stated that one of the major obstacles in climate negotiations is the tension between the North and South stemming from developmental issues (for example Roberts & Parks 2006). This division between North and South is taken as the acknowledged starting point for this paper. Barrier-blocking identification means the division in the context of climate negotiations.

It must be kept in mind that we cannot know the speaker's intentions for sure and they are better left outside the analysis. However, this problem is not very crucial here: the relevant question concerns the audience's comprehensions of the speeches. As a researcher, the best position I can get is to relate myself to a kind of “mediocre listener”, trying to understand both the North and South perspectives.

2. Results

Issue 1: The seriousness of climate change

In a negotiation or public discussion certain participants often have the power and ability to define the debate and therefore turn it to their side: as Michael Bruner and Max Oelschlaeger state in their article,

"whoever defines the terms of the public debate determines its outcome. If environmental issues are conceptualized, for example, in terms of "owls versus people," then the owls (and the habitat that sustains them) do not have much of a future" (Bruner & Oelschlaeger 2008, 218). This problem is also present in climate change discussion: it seems that the North has had the power to define the debate's terms with its scientific and economic dominance. Climate change has become a question of measuring and cutting greenhouse gas emissions, that is to say, it has been reduced into a technical and scientific question reflecting the present Western worldview.

Obama labels the climate change as "a grave and growing danger to our people", declaring conviction about this danger's reality. He makes a reference to scientific evidence and reminds the audience that climate change will pose risks to mankind and the planet. There are two notable issues in this rhetoric: firstly, Obama expresses the scientifically oriented concern for climate change. Secondly, and more importantly for North-South dynamics, he talks about a *danger* that *will* cause risks unless handled. This is temporally oriented to future, stating implicitly that the relevant dangers are ahead but not yet actualized. This can be considered as downplaying the South's present distress which may have caused dissatisfied reactions among the South's representatives.

Blair did not try to speak about an undoubtedly proved phenomenon, but reminded his listeners that "there is a huge amount of scientific support for the view that the climate is changing and as a result of human activity. Therefore, even purely as a matter of precaution, given the seriousness of the consequences if such a view is correct, and the time it will take for action to take effect, we should act." He put emphasis on the accord's urgency, to getting the world moving and to pursuing the path to a low carbon future. This concern was scientifically rhetorized and, in a way, was calmly distant from the heated debate, but still it can be considered as strong concern that was supported coherently by other parts of Blair's speech: the urgency rhetoric here was barrier-crossing towards the South.

China's representative Jiabao Wen admits that climate change is a major global challenge and a rather severe one as he calls the actions "saving our planet". He reminds the audience that this challenge is common for every nation and individual. There are neither rhetorical references to the scientific basis (language typical to North), nor rhetoric regarding the urgency and real presence of the climate change typical to South. This distinguishes China's language from both North and South in this point.

Mugabe's (Zimbabwe) concern was more concrete, strong and did not lack vivid expressions. He took climate change very seriously; for him, climate change was not something that would take place in the future. For Mugabe, climate change's consequences "have become all too abundant to be denied or ignored, they become more poignant each day that passes, that includes today". His part of the world, the South, is the drowning and burning tragedy demonstrating the consequences of the North's development path. Mugabe was not subtle in expressing this division of the guilty ones and those that face the consequences.

Zenawi who represented the whole African Union group (consisting of 53 African states, including Zimbabwe) was distinctively more cautious and kept the rhetoric on a more conciliatory spirit. Yet he describes climate change as a severe, catastrophic problem with clear scientific evidence. The temporal argument of climate change taking place already today was also expressed. The change is described as destructive and unpredictable; interestingly this rhetoric unites both the North's scientifically oriented and South's empirically focused approach to describing the phenomenon. Therefore, I suggest that Zenawi's rhetoric in this issue succeeded in barrier-crossing identification.

Every speaker expressed adherence to the argument that climate change must be taken seriously and that it has a strong scientific basis. This forms a possible basis for collaborative identification of all negotiators. However, the negotiation framework itself takes this acknowledgement as a starting point, so this result is not a giant leap towards collaboration. The problem was that, as speeches revealed, the North and South experience climate change very differently. The North's future-oriented and rather technical view on the issue conflicts with South's hour of need. As a result, the barrier was more blocked than crossed.

Issue 2: Place in the North/South map and the view of "the other side"

The North-South clash can be seen in the different views about "real environmental issues", the North building mistrust by changing the earlier agreed text parts and debates about justice issues in the climate negotiation context (Roberts & Parks 2006, 211-239). Taking a new collaborative approach would mean that the representatives had to reform their identities and the conceived identities of the other side on this North/South "map". There would be no more "suffering South under continual colonization" or "North that has to do all the sacrifices while South keeps on going and growing" (these pictures are intentionally aggravated to point out the differences).

Obama places the United States on the climate change map as follows: "As the world's largest economy and the world's second largest emitter, America bears our share of responsibility in addressing climate change, and we intend to meet that responsibility." Being the largest economy, the United States clearly takes its place on the very top of the North – and right after this, it reminds the audience that it is *not* the largest emitter. As every participant in the climate negotiations probably knew, China (identifying itself with the South) has taken the largest emitter's place, Obama's rhetoric can be seen as mixing the North-South opposition but in a rather questionable way. A modest interpretation is that Obama just wants to make it clear that the United States is doing better in the "emissions per economic unit" scale than China. There may, however, be a broader message: namely that the North is not the only player in the field of emitting greenhouse gases in alarming amounts. In any case, the expression implies that "someone else" (the world's largest emitter) has done things worse as it causes more emissions with less economic activity.

How about Obama's view of the "other side", the South? He mentions the importance of the adaptation fund, especially for the least developed and most vulnerable countries. Otherwise, discussion of the South is neglected in the speech, except in the passages where some reference to China is made by talking about major economies in general. This could be seen as identificationally neutral, but as it is commonly known that the South was waiting for the North to promise some hope in the form of aid, the lack of South-related rhetoric in Obama's speech can be seen as an example of "ignorant North", possibly resulting in a barrier-blocking identification.

As was mentioned, Blair's role in Copenhagen climate summit has a bifurcated nature. Firstly, Blair was introducing results of the (non-governmental) Climate Group that discussed the conflicting points of the Copenhagen summit, aiming to increase the possibility of an accord. However, Blair was usually referred to as the "former Prime Minister" (of the Great Britain) in the news. This association may have been stronger than the organizational one. Blair also still lives in the North, and is perceived as viewing climate issues through the "Northern lens".

Blair makes a division between developed and developing nations, recognizing their different interests. He also identifies China and India as special cases, populous nations growing so rapidly that despite their developing status their emissions are and will be significant in world's scale. Although the divisive elements are present, Blair's speech strongly emphasizes the importance of unity regardless of the differences between North and South (and inside the South). For him, the crucial point of the Copenhagen summit is "to make sure that everyone is on the train, going in the same direction". He attempts to identify with South, and overcome the obstacles.

China's view of its place in the North/South map was an interesting question, as it has often been categorized as a newly industrialized country, being in transition between old categories. Being the most populous state in the world and having an explosive economic growth during the last 15 years (time scale that equals with climate negotiation history) makes China a special case in the climate change puzzle. China's absolute annual emissions are largest in the world; yet its emissions per capita are far below those of most developed nations.

China's view of its own position soon becomes clear: Wen mentions that "China was the first *developing country* to adopt and implement a National Climate Change Program" (italics mine). Later it is also emphasized that China has 150 million people living below the poverty line and consequently it is crucial to develop the economy and their livelihoods. However, there is a clear duality in China's argumentation about its place in the North/South map. Other speakers, identifying with South, briefly talk about their current emissions and mainly refer to the future framework, mentioning how their future will be low carbon and that so far their emissions have been unsubstantial. China does not try to argue this way; by describing its "intensive efforts in energy conservation and pollution reduction in recent years" and "unremitting effort" to fight against climate change, China admits its great share of the world emission chart.

As China conceives itself mainly as a developing country and a part of the South despite emissions comparable with the Northern countries, it is interesting how it talks about future obligations and the most important principles of the possible accord. Wen states that "developed countries must take the lead in making deep quantified emission cuts and provide financial and technological support to developing countries." China is not the one that should then take the lead in emission cuts, but should it be among the receivers of the North's financial and technological support? Wen's rhetoric is so equivocal it is hard to say anything about this issue. It can however be said that China prefers to place itself among the South, willing to be seen as the leading climate change fighter in that group.

When looking at Zimbabwe's speech made by Mugabe, the difference, compared to other speeches, is remarkable. Mugabe is a strong representative of the South, unwilling to seek any similarities or positive connections between North and South. Mugabe starts by focusing on the South, his own part of the world (in Mugabe's words). In the South, rains fail, land becomes lifeless, lands burn or drown in a tragic way. He paints a picture of the South with colorful yet desperate and frantic words.

After this, Mugabe moves to paint the next picture of the North. He disapproves, maybe even despises, the "unfriendly model of development pursued by some of us in the so-called highly-industrialised developed world". The South's lack of trust for the North is perceptible throughout the rhetoric. This attitude stems from historical issues, as the North has based its development on earlier colonial models, making the South suffer from poverty, and now even more so as the consequences of the North's development have become a climatic tragedy for those who are merely trying to rise from

poverty and tend the world's lungs. According to Mugabe, the North has spit on the Kyoto protocol and has severely violated human rights by its actions.

The opposition between North and South is reconstructed as nearly insurmountable in Mugabe's rhetoric. There is a chasm between the "suffering us" and the "destructive, ignorant them". For Mugabe, the North is so guilty and ignorant of the larger part of the world that it should take a giant leap to give the South any hope that it could take human rights issues, the South's development needs and climate change seriously. For Mugabe, some negotiation seems to be possible only after that. For now, the barrier is blocked.

Whereas Mugabe spoke on behalf of his own country, Meles Zenawi represented the African Union that consists of 53 African states, having nearly every African country as a member and therefore forming a rather large share of "the voice of South" (yet it must be kept in mind that South does not refer only to Africa). Despite that, his rhetoric considering this North/South mapping is rather different from Mugabe's. Before turning to discuss Africa or the North, Zenawi speaks of how climate change challenge tests "whether we as a global community are able to rise over our parochial interests to protect our common destiny". This is a call for identification of all the negotiators and all mankind; a call for barrier-crossing identification. For Zenawi, "we" refers mostly to the global community, not merely to the Africa(n union).

Next comes the view of South, especially Africa. Zenawi reminds his audience that Africa has contributed virtually nothing to climate change but it has faced the hardest consequences so far. The North's actions are not left unsaid: as Zenawi relates, Africa's misery is the price "for the wealth and wellbeing that was created in the developed countries through carbon intensive development. That is fundamentally unjust." This forms, to some point, an unavoidable dichotomy between the North and South. However, Zenawi's reaction and rhetorical move after this differs much from Zimbabwe's: "we are not here as victims nursing our wounds of injustice of the past [...] but as stakeholders of the future reaching out across the continents, so that together we can build a better and fairer future for all of us.". This creates a possibility for a new dynamic between the past and the future, as well as the North and South. Zenawi calls Africa the continent of the future. This is a different voice from those that assign Africa a mere victim's role. Africa – and perhaps we could hopefully broaden the reference to concern South – is elevated from an immobilized victim to an emerging active negotiator and stakeholder of the future.

Nations maintained rather stereotypical North and South identities: developed nations admitted their responsibility for earlier emissions, but argued they are already bearing their responsibilities related to that issue. Developing nations considered themselves as unjustly suffering from the North's actions, demanding financial compensation for adaptation – but not only for that; for developing countries the climate change issue is strongly linked to broader development and inequality questions (this is discussed also in *A Climate of Injustice*, Roberts 2006). The North and South "map" formed strong boundaries that nations mostly maintained in their rhetoric, resulting in barrier-blocking identifications. Yet some attempts for barrier-crossing identification emerged, especially from the African Union.

Issue 3: Action suggestions

One of the main questions in climate negotiations is naturally the action plan: who should do what, what are the relevant time scales of action, and which are the most important objectives at the moment?

The United States rhetorically repeats the call for acting together; Obama mentions in his speech that the question is "whether we are acting together or splitting apart and whether everyone understands that the accord cannot give everyone everything." This refers to those of the South that may demand funding without conditions and those of North that would like to give a greater share of the mitigation burden to the world's fastest-growing emitters. A division is rhetorically reconstructed here. Since Obama has described earlier in his speech how his nation is meeting its responsibility in the climate challenge; as I already mentioned, that rhetoric and argumentation seems doubtful. Actually, the audience may doubt that the United States itself would like to give more burden to the fastest-growing emitters. The rhetoric is divisive not only at the global level (reconstructing the North-South-opposition) but also inside these two groups, resulting in dual barrier-blocking identification.

In other parts, Obama's rhetoric about continuation strategy emphasizes the decisive national actions of the major economies, followed by a comment stating that "many of us have already done so". The rhetoric of decisive national actions may imply unwillingness to make global, ambitious and binding commitments – although I'm not sure about this interpretation, it gets more support from the fact that Obama uses rich words to 'effectively' prove that his nation meets its responsibility and is already on the course of action. When it comes to South, Obama argues for establishing the fund. He uses different timescales than the African Union, but it seems that Obama promises a little less than the South called for. This funding is also rather conditional; the long-term financing of 100 billion dollars by 2020 is suggested on the condition that the fund be a part of a broader accord described by Obama. As the South lacks trust in the North, taking the climate change and South's distress seriously, Obama's conditional rhetoric about funding probably does not build this trust which is so urgently needed.

Regarding the strategical rhetoric (suggestions to the question "what is the most important thing to do now / what should be emphasized"), Blair emphasizes the importance of the deal. He states that the objective for Copenhagen is "to get us moving. To be the signal set that makes us switch track to a low carbon future. And to make sure that everyone is on the train, going in the same direction. " This rhetoric of the same train is also an attempt to diminish the oppositions between North and South, suggesting that the next step could be taken together despite earlier disagreements.

Blair reminds the audience that the pathways and more precise goals can be adjusted later. He clearly tries to focus on the possibility of an accord in Copenhagen despite the accord's incompleteness and the divisive issues that would be left unanswered. It is important for him that the commitments are made now by everyone. Therefore, focusing on the short-time targets is emphasized more. In the short term, the mitigation obligations fall mainly to the North, along with the commitment to start the fund for the South. When these kind of demands are laid out by a speaker from the North, they can be considered promising attempts to express the willingness to act and overcome the hurdle between North and South. The problem is that since Blair is actually representing a non-governmental organisation, he may fail to identify with the nations of North here, even if he succeeds in reaching out to the South.

When it comes to China, its view on the best continuation strategy reveals how it tries to take the dual role as both a developed and a developing country. As China's economy has exploded during the last

15 years, it cannot label itself as a developing country needing financial assistance. The earlier rhetoric also revealed that China was under a pressure to emphasize its climate actions; in greenhouse emission terms, China could already be counted as a part of North. How about the rhetoric regarding the Copenhagen accord's content? Wen emphasizes the importance of sticking to Kyoto Protocol principles. He admits the importance of long-term perspective but states that "it is even more important to focus on achieving near-term and mid-term reduction targets, honoring the commitments already made and taking real action". This can be interpreted as favouring China's situation, as in the earlier accords it is listed among the non-Annex I countries (to say South) but in the longer term, it will certainly be considered a developed country, facing stricter emission mitigation goals. China demands action from the North, trying to avoid being labeled as a part of the North.

Zimbabwe takes a rather different stand from Blair's. Firstly, there are actually no arguments made by Mugabe that relate directly to the question about the continuation strategy. On the other hand, he speaks much about what should be done next: funding the South is the key demand in Zimbabwe's speech. In addition, the whole picture is clarified by demanding that the North "takes serious and effective measures to cut emissions on the one hand, while supporting developing countries to adapt to and mitigate the effects of this man-made planetary, if not cosmic disaster" on the other. The suggestion is clear, yet it leaves the gap between North and South as wide as it was conceived in Mugabe's speech overall. For Zimbabwe, the climate change challenge does not seem to imply acting together; the situation is more about waiting for the North to compensate its wrongdoings and change its action. What would be sufficient for Zimbabwe is left open, but the standard appears to be very high.

The African Union is more practical in its communication about the continuation strategy. Zenawi describes a very detailed funding proposal, stating what would be "enough" for South (at least on behalf of the African Union). Zenawi suggests a start-up fund as the beginning, having 10 billion dollars per annum for the next three years. In the following years, the long-term funding should reach 50 billion dollars per annum by 2015 and 100 billion by 2020. He also describes the criteria for the administration of the fund, for example, the board of trustees should have an equal number of both North and South representatives. Here the South clearly calls for funding from the North, but on the other hand it has lowered its expectations from some earlier demands, Zenawi clearly states what would be enough for now and thirdly, the administrative suggestions could be considered as conciliatory towards North (as the administrative places would be shared fifty-fifty).

Some agreement existed in a very general level about the question of who should do what: developed countries should mitigate the emissions and support the developing countries that already face the negative consequences of climate change. There was, however, strong disagreement about sufficient level of these actions. The North's lack of ambition in emission mitigation and adaptation funding results a barrier-blocking effect. As a transitional stage nation, China had some potential to act as an example of overcoming the obstacles, but it withdrew from any promises. The South and North approached each other in the action questions, but their clash remained still stronger than collaboration.

3. Conclusions

The analysed speeches clearly support more division than barrier-crossing identification. Copenhagen failure was present in the main public speeches. Success can be found at the level of considering climate

change as a serious problem and understanding that some emission mitigation is necessary. After this baseline, potential for identification overcoming the North-South clash is minor. Nations focus on expressing their own status and achievements instead of discussing bases for common agreement. Most expectations were set on the United States as it declared to be the negotiation leader, but on the grounds of this analysis Obama's speech actions did not live up to these expectations. On the other hand, the African Union's speaker Meles Zenawi gave hope for future negotiations with his barrier-crossing rhetoric.

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THE ROLE OF LEGISLATION AND POLICIES IN PROMOTING ECOLOGICAL SANITATION: CASE ZAMBIA

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ABSTRACT – *The aim of this paper is to analyse how ecological sanitation (ecosan) is considered in Zambian legislation and policies and the prospects of ecosan in the current political environment. The term ecosan means sanitary methods which facilitate the recycling of human excreta back into the soil preferably in the form of fertiliser.*

Zambian legislation does not mention ecosan specifically in any way. The sanitation legislation is written rather generally, and the legislation on fertilisers does not specifically disallow utilisation of human waste. On the policy level, sanitation is often seen as a housing and health issue, while environmental and sustainability perspectives are left out entirely. Overall, the ministries have varying interests, which leads to uncoordinated and conflicting policies.

In practice ecosan is used by communities, though the method is not widely accepted. Theoretically, ecosan is supported by authorities but because the decision making process is widely decentralised, the responsibilities have become unclear. Ultimately, the result is a continuous cycle of policy and practice affecting each other without change and with little regard to the multidisciplinary nature of governance. To break the cycle, the policies ought to conform to the practices in order to promote and ensure safe and sustainable sanitation.

Keywords: *Ecological sanitation; legislation; Zambia*

1. Introduction

This paper aims to demonstrate the status of ecological sanitation (ecosan) in Zambian legislation and its effects in practice. In order to understand the sanitary aspects of Zambian legislation, one has to understand first *a)* the current situation in Zambia regarding sanitation, and *b)* how and by whom the legislative system operates. Eventually, effective implementation of legislation culminates to the successful enforcement of law in practice. This paper aims to determine the relationship between the Zambian policies and the actual practices involving ecosan, examining both sanitation and irrigation

aspects. Through the scrutiny of legislation and policies it is attempted to learn how the written documents and strategies conform to the practices.

Ecological sanitation is a viable option for improved sanitation. However, to ensure the full benefits of the system, the use of human excreta must be allowed as fertiliser to finalise the nutrient cycle. In this paper the situation in Zambia is described: could ecosan be a potential solution for the country's sanitation problems, and how does the legislation enforce this. The areas studied here vary from legislation on housing and public health to environment and agriculture – to ensure the legality of ecosan and the reuse of nutrients in all aspects of society. Yet, it is challenging to maintain a common line of policy in all the sectors, and often it is possible to see a notable difference in the motives of authorities, which leads to a continuing cycle of debate and conflict.

2. Sanitation in Zambia

The sanitation situation in Zambia remains poor. Especially in the peri-urban areas in the outskirts of towns, where the population is rather dense, it is difficult to organise proper sanitary facilities. Sewage infrastructure does not reach the outskirts and renovations would require additional investments; something the country simply does not have resources for. Traditional pit latrines are the main sanitary facility, but high water table and heavy rains in the rainy season increase the risk of polluting the groundwater and thus enable the spreading of diarrhoeal diseases such as cholera causing epidemics nearly annually.

These figures, however, do not take into account the definition of improved sanitation. Improved sanitation, by definition in the National Rural Water Supply and Sanitation Programme (NRWSSP) of 2007 includes ventilated improved pit (VIP) latrine, a pit latrine with a sanitation platform, a traditional pit latrine with a smooth floor surface, an ecosan latrine, a flush/pour-flush latrine and a septic tank latrine (Republic of Zambia 2008). However, the figures from the Central Statistics Office (2006), are based only on VIP latrines and flush toilets. The lack of clear definition makes the measurement difficult. The figures used here are based on the Zambian Health survey of 2007, who define adequate sanitation as follows:

“A household is classified as having an improved toilet if the toilet is used only by members of one household (i.e., it is not shared) and if the facility used by the household separates the waste from human contact.” (WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation, 2004)

According to the survey, 43,7 % of the urban population and only 12,9 % of the rural population had access to an improved sanitation facility, bringing the total to 23,9 % of the Zambian population having adequate sanitary facilities. Most toilet facilities were flush/pour flush toilets or improved pit latrines – composting toilets appeared only 0,1 % in the urban areas. 23,5 % of the population has no sanitation facilities of any kind, with the percentage being 1,8 % and 35,4% in urban and rural areas respectively.* (CSO *et al.* 24, 2009). Improving sanitation conditions is one of the Millennium Development Goals but

* Due to unclear definitions, the figures differ radically. Here I have chosen to use the latest Zambian figures. For comparison, the figures from UNICEF indicate that 52 % of the population use improved sanitation facilities, with the urban and rural sanitation coverage being 55 % and 51 % respectively (data from 2006).

so far the target seems out of reach. The annual population growth rate was 2,3 % in 2000-2008, and with the total population of 12,6 million it means several more people without adequate sanitary facilities. Inadequate sanitation causes spreading of diseases such as cholera and dysentery. Contaminated water and unhygienic disposal of excreta increase exposure. The under five mortality rate in Zambia is one of the highest in the world at 148/1000 live births and diarrhoea accounts for approximately 1/5 of all deaths among infants. (UNICEF 2008.)

Another threat to sanitation is the growth of urban population, which usually indicates an increase in inhabitants of peri-urban areas. In 2000-2008, the growth rate of urban population was 2,5 %. In 2008, the urbanisation rate was 35 %. (UNICEF 2010.) According to statistics, composting toilets only account for 0,1 % of the latrines in urban households in Zambia (CSO *et al.* 24, 2009). The target for sanitation coverage in rural areas is 35 % by 2010 and 60 % by 2015, whereas in the urban areas the target is 70 % by 2010. (National Water Policy 1994.) In the light of our current knowledge, the targets are far from reached.

3. Ecological sanitation

Ecological sanitation, or ecosan in short, is meant by sanitary methods which allow the recycling of faeces and urine back to soil. An ecosan latrine is considered as one method of improved sanitation, with the added bonus of it providing fertiliser in form of diluted urine and composted faeces. (International Hydrological Programme 2006, 11.) In this paper, the term ecosan covers only the composition of human faeces and separation of urine for fertiliser purposes, and thus refers to the use of dry toilets with separation facilities.

Traditionally, human waste has been used as fertiliser in Zambia, and although it is not widely discussed, informally the method is accepted. Especially poor farmers who cannot afford to buy inorganic fertiliser often buy and sell human manure as fertiliser. People in peri-urban areas are known to take their irrigation water from sewage line, which has been found beneficial for the growth of the vegetables. (ECZ 2010; Lusaka City Council 2010.) However, if not treated properly, human waste can be a serious threat to public health.

According to the *Integrated Land Use Assessment* (2005), most small-scale farmers cannot afford to buy inorganic fertiliser to meet their production requirements. This means that farmers can increase productivity only by expanding the cultivation area or using shifting cultivation, which have negative effects to forest areas. Only 11 % of small-scale farmers buy fertiliser, while only less than 1 % invests on irrigation facilities. The poor productivity of land has effects on nutritional health but also on the surrounding lands under agricultural pressure. Crop diversification is being considered in order to improve food security to promote alternative grains such as sorghum or millet, which are not as dependant on fertiliser.

The need for recycling nutrients for fertiliser use and irrigation does not require an immediate lack of water. The high potential of underground water aquifers in Zambia is largely unexploited. There are over 1 740 380 million cubic meters of underground water resources, as well as plentiful surface waters. (The National Agricultural Policy 2004-2015, 2004.) *The National Irrigation Plan* (2005) proposes “full, efficient and sustainable exploitation” of these said water resources to ensure agricultural production of various crops. Of Zambia’s entire irrigation potential, estimated at 423 000 ha, only ca.

50 000 ha are currently irrigated. However, Zambia has suffered severe droughts from time to time despite the abundant water resources. (National Agricultural Policy 2004-2015, 2004.)

4. Ecosan in practice

In general, dry toilets and recycling of nutrients is already a reality in Zambia. Human waste has been used as fertiliser as a standard procedure even with old fashioned pit latrines. The increasing amount of ecosan projects has created a growing interest towards urine separating dry toilets and the use of plain urine in small scale irrigation. It is reported by several authorities, that it is difficult to have an open discussion of sanitation due to cultural issues – it is considered to be a private matter. Incidentally, handling human waste is traditionally been work for the poor and the mad, so utilising the product becomes a problem. (MLGH 2010.)

Even though unhygienic pit latrines are technically not allowed, the local authorities have no option but to accept them due to various reasons, such as lack of resources. It is not possible to provide sewage connection to all areas and even proper latrine construction can prove to be too expensive for the people. (Lusaka City Council 2010.) This is why ecosan would be a suitable option for providing sanitation to even densely populated and remote areas. However, the lack of information rises up as one of the major challenges. Indeed, ecosan could be one acceptable and recommended sanitation method, but because of lack of knowledge, the authorities do not see a reason to promote it. Furthermore, legislation cannot be changed to promote dry toilets until some authority is willing to start work on the process. So far, the benefits of ecosan are known by individuals but the units responsible are not convinced enough to start working on a policy or a strategy on ecosan. (MoH 2008.) The result is a cycle of recommendation leading to proposal, only being then cancelled by an existing motion. The political priorities are often limited to one single sector and multidisciplinary planning is forgotten. This may lead to a continuous cycle where policy affects practice and vice versa, leading nowhere. (Ascher and Healy 1990). This stationary movement which appears like development can be recognised from the conflicting laws and policies present in Zambian society – as described below.

5. Legislative system in Zambia

The legislative system in Zambia revolves around separate administrative and governmental bodies. The Parliament, responsible for enacting legislation, consists of the National Assembly and the president, both elected by the people for 5 year terms. The unicameral National Assembly has 150 parliamentary constituencies who stand for elections and eight nominated by the president, as well as the speaker. (State House 2009.)

To oversee government administration and subject its activities to scrutiny on behalf of the electorate, the Parliament has established parliamentary committees that conduct surveillance on defined areas of government administration. A parliamentary committee system enables Parliament to probe into any maladministration and make recommendations for improvement. (National Assembly of Zambia 2010.)

When a change in an act is to be initiated, local authorities along with the relevant ministries and authorities start doing the groundwork. In the case of ecological sanitation, the main responsibility would lie upon the Environmental Council of Zambia (ECZ) and the National Water and Sanitation Council (NWASCO). Together with Ministry of Local Government and Housing (MLGH), Ministry of Health (MoH), Ministry of Energy and Water Development (MEWD) and Ministry of Tourism, Environment and Natural Resources (MTENR) they would complete stakeholder analysis and collect comments from the public – all the preliminary work needed to initiate a change in legislation. (ECZ 2010.)

The draft, prepared by these authorities, would be presented to the Parliament for the first reading, after which the bills are referred to relevant committees. The committee hears selected experts and calls upon presentations from institutions and NGOs. Eventually, they will determine which act is to be changed and in what way. (National Assembly of Zambia 2010.)

The Parliament enacts legislation through bills passed by the National Assembly and assented to by the president. Any member of the National Assembly may introduce bills in the Assembly. Once a bill has been submitted to the president, it must be within 21 days assented to by the president or referred back to the speaker for reconsideration. Every citizen has a right to petition Parliament to enact, amend or repeal any legislation, as well as has a right to comment on discussion and debate at the Parliament. (Constitution of Zambia Act 1991; Interpretation and General Provisions Act 1994.) If an issue does not require an official enactment of Parliament, simple regulations can be put into force by decisions of the relevant ministry (ECZ 2010). In addition, for the Parliament being able to change or create acts, also the local authorities can make by-laws for “the good rule and government of its area”. The by-laws are confirmed by a minister. (Local Government Act 1991.)

The issues involving sanitation, ecological sanitation and recycling of nutrients are spread over a rather wide area of legislation, from housing to public health, water and agriculture. The most important pieces of legislation are briefly described in Table 1.

Table 2. The main pieces of legislation on sanitation and recycling of nutrients.

Legislation	The Main Objectives
The Local Government Act (1991)	Obligates the local authorities to establish and maintain sanitary convenience and ablution facilities as well as provide a clean water supply and prevent pollution of water courses. Sanitary facilities are limited to "drains, sewers and works for the disposal of sewerage and refuse", and while the act is not limited to that definition, no other definitions are specifically mentioned.
The Public Health Act (1995)	"No person shall permit any manure or garbage on his premises or land, so as to be a nuisance or dangerous to health by affording facilities for breeding by flies or other insects". The Act strongly prefers water closet as the type of latrine. In fact, an owner of a non-water closet can be asked to replace their latrine with a water closet. More primitive "pail closet" (latrine accommodation including a movable receptacle for human excreta) and "pit closet" (latrine accommodation situated over any hole or excavation in the ground) are allowed only in exceptional cases, and a permit from a local authority is always required. A dry toilet is not at all allowed within a dwelling house. In general, pit latrines are forbidden.
Water Supply and Sanitation Act (1997)	Defines the duties of the National Water and Sanitation Council (NWASCO): The council acts as an advisor to both the government as well as for commercial utilities and other actors, and is responsible for establishing and enforcing standards for sanitation and developing guidelines for the sector.
The Water Act (1994)	Mainly concentrates on the ownership and the user rights of water bodies. Pollution is forbidden but the details are vague. Currently being reviewed by the Parliament (2011).
The Environmental Protection and Pollution Control Act (1999)	Discusses the use of any effluent, but limits the definition to all agricultural, industrial and domestic wastewater. The act forbids the dilution or discharge of wastewater without a license, assuming the licensed wastewater treatment facilities are up to the environmental standards.
The Agriculture (Fertiliser and Feed) Act (1994)	Defines fertiliser as "any substance or compound of substances, which is intended or offered for sale, or sold, for use in the improvement or maintenance of the growth of plants or of the productivity of the soil; but does not include farmyard or stable manure; kraal manure, compost, wood ash, town refuse or night soil, when sold in its original conditions and under its name". However, "compost" means here decomposed vegetable or mixed vegetable and animal matter forming organic manure. In this piece of legislation, human manure is not discussed in any way.

6. Legislation enforcement in practice

The law, whatever it may state, is only a tool to achieve desired results. However, eventually it is predicated on enforcement and implementation to see if the law is effective. In general, the authorities see ecological sanitation as an excellent way to tackle the sanitation problem especially in peri-urban areas. (LWSC 2010; Lusaka City Council 2010.) The law states that use of untreated human waste as fertiliser is not allowed, but does not mention separated, diluted or composted waste. Similarly, the law has certain requirements for latrines inside a dwelling as well as near boreholes and kitchens. Otherwise dry toilets are not specifically mentioned. The authorities do not see anything wrong with ecosan *per se* but underline the correct use of such toilets.

Since the legislation does not clearly mention ecological sanitation, its use is not either forbidden or promoted, and the overall view on ecosan is left unclear. The various national policies, however, do not seem to encourage in the use of ecosan, and tend to concentrate on flush toilets, inorganic fertilisers and exploitation of groundwater for irrigation. The policies set by various ministries are guidelines for the local authorities as well as the communities to show which direction the development is intended to be heading. The most relevant policy documents and their objectives are described in Table 2.

Table 3. The main policy documents on sanitation and recycling of nutrients.

Policy	The Main Objectives
National Health Strategy Plan (2005)	Includes the strategies to improve environmental public health, such as strengthening capacity in enforcement of environmental health policies and legislation as well as promoting the provision of appropriate and suitable water and sanitation facilities in peri-urban and rural areas. In order to achieve this, the Public Health Act and the Food and Drugs Act and National Environmental Health Policies have been reviewed and developed.
The National Water Policy (1994)	<p>Enforces separation of water resources management from water supply and sanitation as well as increasing the use of technologies more appropriate to local conditions. One key aspect of the policy is to increase the government priority and budget spending on the sector, which already heavily supports plain water resources instead of integrated sanitation services. Programmes on development of national rural and urban water supply and sanitation have been launched in 2008 to improve the conditions in the country.</p> <p>The policy also raises the point of the abundance of water resources and assures that the growing demands on water for all its usage could be met. However, the water resources rely heavily on surface water, as groundwater usage is hardly monitored or regulated, being privately owned. Water saving in irrigation is being supported, but there is no mention of potential use or even research on wastewater in irrigation.</p>
The National Agricultural Policy 2004-2015 (2004)	Aims at the promotion of sustainable and environmentally sound agricultural practices and irrigation development. However, the policy emphasises mainly the high potential of underground water aquifers which are largely unexploited. The National Irrigation Plan (2005) proposes “full, efficient and sustainable exploitation” of these said water resources to ensure agricultural production of various crops. The objectives are to promote sustainable technologies for adoption by small-scale farmers, by developing alternative soil nutrient sources and the use of input technologies.
National Policy on Environment (2005)	Lists the main challenges of Zambia, including deforestation at 250-300 thousand ha per year, land degradation in many areas which face deforestation, soil erosion, and inadequate sanitation and water pollution. This is due to insufficient incorporation of international standards within national legislation as well as limited involvement of local communities in the implementation and enforcement of related legislation. Also lack of cooperation between the authorities and coordination mechanisms for effective integration of legislation are part of the problem due to insufficient resources.

The number of actors involved in sanitation, wastewater treatment and agricultural issues is vast. Not only is it challenging to find suitable solutions for inadequate sanitation and degradation of nature but it also requires a great effort to agree on exact goals, priorities and responsibilities amongst the various actors. (Ascher and Healy 1990). As can be seen from tables 1 and 2, the goals of the different pieces of legislation and policies vary greatly from sector to sector. A uniform view is yet to be found.

The local authorities have to cooperate with other actors, such as commercial utilities, nongovernmental organisations and communities. In the sanitation sector alone, much of the actual wastewater treatment is dependent on commercial utilities, such as the Lusaka Water and Sewage

Company (LWSC), who are in charge of emptying the septic tanks and treating the wastewater. However, in many bigger towns the sewage network does not cover the vast peri-urban areas and the existing network is pushing the capacity of the current treatment plants. It is up to the local authorities to provide the people with sanitary facilities.

The Ministry of Government and Housing (MLGH) is in charge of sanitation in general: providing regulations and supervising sanitary conditions of communities. This is done in cooperation with district councils, who in turn cooperate with village boards and chiefs. The Ministry of Energy and Water Development (MEWD) is mainly concerned with the water resources and the Ministry of Tourism, Environment and Natural Resources (MTENR) has the environment's best interests at heart. The Ministry of Agriculture and Cooperative (MACO) concentrates on irrigation and fertiliser issues, but has little to say about ecosan. The National Water and Sanitation Council (NWASCO) is mainly the body in charge of cooperation and putting together water and sanitation resources; however, the ecosan aspect is often forgotten as sanitation is not seen directly as an issue of agriculture or environment. The Environmental Council of Zambia (ECZ) and the Ministry of Health (MoH) are interested in environmental sanitation and its effects to environmental health, but the dialogue between the authorities is up to resources and sometimes proves difficult.

Concerning the amendment of the legislation, it appears that the authorities find it difficult to find a consensus. Evidently all the parties involved seem to think that adding ecological sanitation clearly in the legislation would make matters easier, especially in terms of definitions of which facilities count as adequate and improved sanitation. They also find that human waste as fertiliser should be allowed in the legislation, even though some still require further evidence of its safety. Yet, no one seems to have the answer to *who* is responsible of changing the legislation. The process is widely known, and it is known that cooperation between authorities is required to form a preliminary draft on the changes, the current situation and the public opinion. In fact, little changes are to be expected in the sanitation sector – only the Water Act is being scrutinised by the Parliament but no additional mentions of sanitation are to be expected.

7. Future challenges

There has been effort to increase the effect of sanitation policies but the same questions keep rising up: resources, definitions, political will and the unfinished process of decentralisation (O'Neill 2008). However, the latest policies involving sanitation and wastewater treatment are limited to only venture after the European standards: flush toilets and centralised water treatment. Still, with the current infrastructure this seems difficult to realise. The abundant water resources do not seem to encourage to water saving sanitation and irrigation methods, which is why the interest towards ecosan is weak. Several people seem to be fascinated by the idea but implementation lies upon NGOs and donor projects.

It has been a target of the Environment and Natural Resources Management and Mainstreaming Programme (2008) to harmonise the legal regime by identifying and prioritising of the needed reforms in the environmental sector and developing an action plan to produce required policies as well as legal and regulatory instruments. It is especially the environmental policy which calls for cross-sectoral laws and regional cooperation to provide a functioning framework to enforce the laws. (National Policy on Environment 2005.)

However, the Zambian laws on sanitation are spread over many pieces of legislation and responsibility for implementation and enforcement is widespread, and this poses a great challenge to the government. This is due to the large number of actors, each pursuing their own interests that recognises various different issues on sanitation, and which has resulted in the development of inconsistencies in legislation. (Environment and Natural Resources Management and Mainstreaming Programme 2008.) Often the critical inter-sectoral linkages are ignored, which causes conflicts in policymaking and especially in the implementation phase.

A solution for effective enforcement of laws has been believed to be the National Decentralisation Policy (NDP), which was launched in 2003 to be implemented for 10 years. The purpose of the policy is to channel and control the resources at district level, as well as to increase collaboration and cooperation between the provincial and local authorities. (National Decentralisation Policy 2002.) This, however, requires restructuring of resources in all areas and at all levels of society. Central and local government should rationalise their responsibilities within an agreed framework, and active community participation should be required. Provincial and district level institutions should be working in harmony with civil society, who should maintain the ownership and responsibility for the policies. However, as of yet the legislation does not take the NDP into account, nor are the local communities involved sufficiently enough to ensure effective enforcement and implementation of legislation.

8. Conclusions

According to the ministries and local authorities, the legislation will eventually change to support the practice, once ecosan spreads wider and becomes more known. However, as long as the attitudes remain suspicious towards ecosan, it is unlikely that the authorities will find the motivation to promote these practices. The priorities of the policy makers differ and it is challenging to find the political will to twist the development to a new direction (Ascher & Healy 1990). It is questionable whether the practices should direct the legislation or is it in fact the task of the authorities to guide behaviour to the desired direction. Additionally, it is important to ask why the current laws do not have the desired effect, such as the carelessly enforced ban of unhygienic pit latrines. It is not only a matter of culture and environment, but also reflects on the needs of the society.

While the Zambian legislation on sanitation is sufficient, it does not take into account the conditions in which some people live. This has been dealt by authorities by allowing some minor breaches of the law but the cause itself has not been tackled. The people have the knowledge and the ideas on how to build safe latrines, and they also use human waste as fertiliser, often in secret. If the government would openly promote the ecosan method, the quiet practices might eventually become widely accepted – as it is eventually the authorities who set the guidelines for the society. Instead of promoting full scale exploitation of the “abundant” water resources, effective wastewater treatment and recycling methods should be considered – if not to save water, then at least to ease the pressure on treatment plants. Cooperation and planning with the commercial utilities might just be the way to learn how to make wastewater recycling profitable and thus desirable. Above all, it is necessary for the ministries to find common goals instead of producing conflicting policies. Otherwise the vicious cycle will continue without improvement.

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GLOBAL GOVERNANCE OF WATER SECURITY IN AGRO-FOOD VALUE CHAINS AND NETWORKS

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ABSTRACT – *This study investigates the sustainability of water security and the global political economy of agro-food value chains and networks. As agriculture is the biggest water user sector, it is emphasized that crucial decisions regarding water security are made by farmers managing irrigation efficiency with different techniques and water endowments, by traders sourcing from farmers in different parts of the world, by processors branding their products, by retailers setting value standards to their brands and by the consumers buying the products.*

However, as power in the global value chains and networks is concentrating in the hands of few conglomerates of transnational corporations and state-led enterprises especially from China, there are stark asymmetries in decision making between different parts of the agro-food system in the global “South” and “North”. The findings of the study suggest that the growing water security risks may further change the dynamics of the agro-food system for the benefit of the powerful bargaining actors. Hence, in order to ensure sustainability of water security from local to global level, actors of the agro-food supply chains and networks need to be brought under greater stakeholder scrutiny and interaction in the context of global water governance and just international trade.

1. Introduction and background

The current multiple world system crises ranging from climate change to economic recession and increasing global inequality ultimately epitomize in the global water-food-energy-trade nexus, where resource scarcity has become the new norm (Brown 2011; Gills 2010). The purpose of this study is to investigate the nexus dynamics from the perspective of water security, concentrating on the role of different actors of global agro-food value chains and networks. It is argued that these chains and networks form a thus far non-evident but increasingly important global water governance structure.

Most economies world-wide are tackling worsening physical, economic and social water scarcity (Kummu *et al.* 2010). Accordingly, focus on water security in this analysis is justified in a wider sustainability context as access to water underlies food and energy security, poverty reduction, economic growth, conflict reduction, climate change adaptation and biodiversity preservation (World Economic

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Forum 2009). As agriculture is the biggest and fastest growing freshwater user in the world it is as an industry at the heart of the water security challenge (UNESCO 2009; Hoekstra and Chapagain 2008). It is the sector most vulnerable to absolute freshwater shortages but also the one with the biggest potential to ameliorate them (Cai *et al.* 2011; Cook *et al.* 2011). The challenge of water security – and its remedy – is global as agricultural produce and hence the *virtual water* embedded in it is traded internationally between regions with different water endowments (Allan 2003, 2001, 1993). International virtual water 'flows' in agricultural trade are comparable to the flows of the biggest rivers in the world. Hence, a global approach to water management is unavoidable in addition to improvements in basin-wide resource management (Hoekstra and Chapagain 2008.)

The complexity of the global water security challenge wields power and authority over water management to multiple stakeholders involved, meaning a shift from *government* to water *governance* (e.g. Mirumachi 2008; Dalby 2002). However, global discourse on water has evolved over the last five decades but no clear governance framework has emerged (Pahl-Wostl *et al.* 2008; Allan 2006). There are no established mechanisms to involve all water users as stakeholders in the water management institutions, at transboundary, national, basin or local levels, nor in the emerging global structure (Pahl-Wostl *et al.* 2008). The emerging global water governance, like the emerging global environmental governance in general, is in the state of "institutional ambiguity" with "no agreed upon norms, procedures or constitution on where and how decisions should be made" (Hajer and Versteeg 2005a:341). Still, the lack of institutional framework does not mean non-existence of policy making: as a departure from 'classical-modernist politics' with clearly defined stages, the decisions on sustainability are made in dynamic global networks (*ibid.*). Furthermore, sustainability of water security is at risk if the political and discursive nature of resource-allocation and power-asymmetries between stakeholders in global water governance are not understood (Allan 2006). Managing water security and water governance are inherently political processes in the global political economy, where corporations and state-led enterprises are increasingly powerful actors (e.g. Gills 2010; Dicken 2007; Sklair 2002; Strange 1970).

Although the literature on hydropolitics is relatively abundant in describing the role of transnational water corporations in water management and supply internationally and as sponsors of international megaconferences as the established forums of global water governance (e.g. Biswas and Tortajada 2009; Conca 2006; Gleick and Lane 2005; Finger and Allouche 2002; Barlow and Clarke 2002), it still suffers from the same neglect as literature on environmental governance in general. It lacks an understanding of "corporate strategy or role within the broader structures of political and economic power" in the global political economy (Newell and Levy 2006:157). Moreover, the focus of research on private sector in global water governance has thus far been on the water corporations even though they only manage globally a small though important proportion of the water compared to the unnoticed majority of water resources managed and consumed in the global agro-food value chains (Hoekstra and Chapagain 2008; Allan 2003, 2001). Water and water security are rising higher in the agro-food corporate agendas and voluntary water accountability initiatives have started to flourish during the past few years but as a separate process from the institutional development of global water governance. Furthermore, power in the world agro-food value chains, both in commodity trade and retail, is concentrated in the hands of a small group of giant western-owned transnational corporations who have been recently challenged by equally powerful state-led enterprises especially from the Arab world and Eastern Asia, notably China

and South-Korea (e.g. Brown 2011; Financial Times 18th May 2010; UNCTAD 2009). Scarcity-induced securitization of resource access on national and business agendas in the form of food speculation and foreign direct investment in land and water, i.e. 'land and water grabbing', further complicates the global water security framework (Brown 2011; Kaufman 2011; Sojamo *et al.* forthcoming). Political decisions on water security are constantly made both in the unnoticed and institutionalised market structures in the overlapping agro-food and water governance networks. The position of the corporate and state-led enterprise actors in the industry structure and in the institutional and ideological setting of the global political economy of water-food-energy-trade nexus are both significant.

This study aims to shed light on the role of the biggest water users – the most powerful corporate and state-led actors in agro-food value chains and networks – in global governance of water security, thus far poorly understood both in theory and in practice. It will especially respond to the need for better understanding of the role of transnational corporations and state-led enterprises besides state and civil society actors as rule makers forming coalitions and networks of global water governance. The emphasis will be on the importance of the thus far non-intentional forms of power of the global agribusiness traders in sourcing and distributing high volumes of water intensive agricultural commodities.

2. Material and methods

Lukes's (2005 [1974]) three dimensions of power – material, bargaining and ideational – and Foucaultian notions of knowledge and discourse as power are applied here with Gramscian ideas of contestation, resistance, and accommodation connecting corporate and state-led enterprise strategies to the global water governance regime (Clapp 2005; Levy and Newell 2002). Corporations can either exercise material, bargaining and ideational forms of power to contest and resist environmental governance regimes, or engage in organisational and discursive practices inside the regime applying Gramscian accommodation strategy in order to position their business interests as collective concerns (Newell and Levy 2006; Dryzek 1997). These latter forms of agro-food corporate engagement in water governance are still rare as water issues are subordinated or only superficially accommodated to most of the corporate strategies (CERES 2010). However, as Newell and Levy (2006) emphasise, also contesting and resisting strategies and, even more importantly, non-intentional forms of corporate power matter in the governance context.

The role of the agro-food corporations and state-led enterprises in global water security and governance can be thus investigated by building the analysis on 1) their power in material conditions from global water management perspective, i.e. their share of international virtual water 'flows', 2) organizational forms and bargaining power in the global agro-food value chain and network governance and emerging forms of global water governance, and 3) ideational power consisting of their knowledge and discursive practices in the wider network setting.

The economic theory of global water management, i.e. calculation of virtual water 'flows' and water footprints (notably Hoekstra and Chapagain 2008), gives the volumetric and geographic perspective crucial to water security analysis, further justifying the research of the corporations in the global agro-food value chain and network governance setting. Power theory of corporations helps to explain the actions of the corporations in the value chains and networks and also in the wider global water governance network context in the global political economy (notably Newell and Levy 2006; Clapp

2005; Levy and Newell 2002). These analytical approaches together provide the framework for responding to the main research question of *what is the role of the transnational agro-food corporations and state-led enterprises in global water security and accordingly global water governance* leading to the following interrelated question with specific sub-questions:

What are the constituents of the power of the agro-food corporations and state-led enterprises in global water governance networks?

- On the material level, how much virtual water do they manage globally in international agricultural commodity trade? Does it contribute to global efficiency gains or losses?
- On the organisational level, what is their bargaining position in global agro-food value chains and networks? How do the impacts disperse globally? What is their engagement in the emerging global water governance structures?
- On the ideational and discursive level, how do they frame water and water security issues?
- Accordingly, what are their interests under worsening global water insecurity and growing need for global water governance?

The multidisciplinary analytical framework presented suggests several research strategies and methods. However, due to the exploratory nature of this study the general research strategy deployed in the investigation was necessarily qualitative and accordingly the research process iterative as the theory was partially grounded in the data (Bryman 2003; Strauss and Corbin 1998).

Based on the ideas of global water management (e.g. Aldaya *et al.* 2010; Hoekstra and Chapagain 2008; Allan 2003, 2001), the first step of the study was the identification of the world's largest agribusiness corporations as major water managers in the global context through their dominance in the international grains trade with unknown implications to global water security. A review of academic and grey literature based on library and internet-based search confirmed the consolidated and concentrated power of a few corporations in the world agro-food system and revealed gaps in the theory of corporations and global water security and governance.

The following phase had two parts. First, virtual water content estimates of the operations of the four largest agro-food transnational corporations labeled as the "ABCD" of global agribusiness (Archer Daniels Midland, Bunge, Cargill and Louis Dreyfus) and calculations of their shares of the international virtual water 'flows' were undertaken deploying the methodology developed by the Water Footprint Network, (notably Hoekstra and Chapagain 2008). This proved to be very challenging due to the limitations of publicly available data of the operations of the corporations and of their market shares. However, sufficient quantitative evidence was found for estimates of their size and efficiency as global water managers. The efficiency comparisons could only be based on physical volumetric savings and losses as social, economic and environmental factors were difficult to weigh accurately in the global context in the absence of data and universally agreed water security indicators (Morrison *et al.* 2010).

Second, eight semi-structured elite interviews were conducted on the strategies of the corporations and state-led enterprises and their practices in global water governance and agro-food value chains and networks. The respondents presented both specialists and stakeholders giving a cross-validated view of the research topic (Berry 2003; Hoggart *et al.* 2002). They included academics from agro-food studies, senior non-governmental environmental organisation and intergovernmental economic organisation representatives, a large international agribusiness consultancy specialised in international grain markets, a vice president of sustainability of one of the largest food companies in the world supplying

from the corporations, and a vice president of sustainability of one of the four largest corporations themselves.

In order to reach the best suited informants a purposive snowballing sampling strategy was adopted at the beginning. Later theoretical sampling technique was adopted in order to gain theoretical saturation of the pre-defined and emerged categories (Bryman 2003; Glaser and Strauss 1967). Semi-structured interview was deemed valid a method due to its flexibility in researching a new and complex topic (Berry 2003; Bryman 2003). Reliability concerns related to the choice of method were minimized by deploying reflective probing tactics in the interviews and re-checking research questions and analytical categories as the interviews proceeded (Berry 2003). Validity issues were managed by triangulating the data with related findings in associated literature to the extent possible.

The analytical process was continuous and reflexive. Initial analytical framework and categories defining the specific research questions were constructed based on the literature review, but they were continuously reflected upon throughout the study.

3. Results

On the material level, the role of the transnational agro-food corporations and state-led enterprises as global water managers and rationale for their importance to global water governance builds on their major involvement in the water intensive international crop trade.

With only sparse market share and non-location specific aggregate operation data it is impossible to give definite accounts of the water footprints of corporations (CERES 2010; Morrison *et al.* 2010). However, indicative estimates of the scale and efficiency of the corporations in focus of this analysis as global water managers can be based on the numbers available by multiplying their associated international crop trade volumes (tonnes/year) by the associated virtual-water content (m^3/tonnes) (Hoekstra and Chapagain 2008). Based on the calculations on the estimated shares of Archer Daniels Midland, Bunge, Cargill and Louis Dreyfus of the trading and processing of the three main globally traded staple crops, wheat, corn and soybeans alone, these four largest corporations could handle up to 50% of the international virtual water flows embedded in agricultural commodities and nearly 40% of the total international virtual water 'flows' embedded in trade (for further details, see Sojamo 2010).

Depart from these results presented indicating major quantitative power of the largest agro-food corporations as water managers, only educated guesses of the contribution of them to global efficiency gains and losses, i.e. qualitative impacts on global water security can be made here as the data available does not differentiate the production conditions of the sourced supply nor where the crops are eventually consumed. Considering that the main grain and oilseed sourcing regions of the corporations in North and South America are *green water* intensive (rainfed agriculture, sustainability of water use connected to land use) and the destination regions in Europe, Middle East and North Africa and Asia *blue water* dependent (surface and groundwater for irrigation potentially needed for other uses) (Aldaya *et al.* 2010), it could be suggested that the corporations contribute to global water efficiency gains and improved water security in the importing countries. On the other hand, the majority of the corn and soya beans traded by the largest corporations goes to animal feed instead of food hence contributing to larger water footprints of diets and both land and water resource scarcity eventually inducing water and food insecurity in the global scale (Liu *et al.* 2008; Heffernan and Hendrickson 2002).

The virtual water 'flows' embedded in the agro-food produce sourced from leased land mostly in Africa, South-East Asia and South America by foreign state-led enterprises are even more difficult to calculate. However, evidence is growing stronger that water is often the ultimate driver for the investments, as the investing countries, particularly China, Saudi-Arabia and Arab Emirates, India and South-Korea do not suffer from lack of land for cultivation but from lack of water for irrigation and in rainfall (Brown 2011; Sojamo *et al.* forthcoming). Sourcing the resources outside the water-stressed home basins is in a shorter term cheaper than investing in water efficiency and productivity measures in situ (Woodhouse and Ganho 2011). Nevertheless, the target regions of the land and water investments often suffer from lack of just regulatory frameworks on trade, land tenure and water use and from underdeveloped water management systems, putting the local water and food security of especially the poorest at risk (Bues 2011; de Schutter 2010; World Bank 2010).

On the organisational level, the power of the largest corporations and state-led enterprises affects both the value chain dynamics and the wider dynamics of the networks of the world water and food security regime.

When looking at water security as a driver in the agro-food value chain dynamics, different picture emerges on the role of the corporations and state-led enterprises depending on whether their strategic preferences are looked at in the shorter or longer term or in value- or volume-driven markets. On one hand, concentration and consolidation especially in the US and UK retail sector and among the brand-name firms focusing on design and marketing dictates the global demand (UNCTAD 2009; Gereffi *et al.* 2005; OECD 2001). Accordingly, increasingly environmentally aware consumer could thus push the value chains towards more sustainable water use practices. On the other hand, concentration and consolidation among the "high volume, low value" agribusiness lead by the largest corporations and state-led enterprises enforces a countering supplier-driven system (Heffernan and Hendrickson 2002; Hendrickson and Heffernan 2002). According to the interviews conducted for the study, the largest trading corporations, especially privately owned Cargill, do not at the moment see much value in voluntary sustainability measures and corporate accountability as they have hardly visible brands and face little shareholder, governmental and non-governmental movement pressure. Instead, if a company with a visible brand supplies from the corporations produce that turns out to be unethically sourced, the reputational risks are on the company with the brand, not on the invisible supplier behind it. The global suppliers do not need to change their practices due to the chain pressure as they can sell their produce to alternative emerging Asian markets where the voluntary and legal standards are lower. Hence, a key question is whether and when the Asian markets will start to favour sustainability. The state-led enterprises leasing foreign land for produce mostly consumed in Asia are increasingly being criticized for their lack of sustainability in land and water use, which has prompted calls for international guidelines and regulatory frameworks, but the planning and implementation process is severely lacking behind the realities on the ground (Bues 2011; Kaufman 2011; Sojamo *et al.* forthcoming; Woodhouse and Ganho 2011; World Bank 2010). Furthermore, transnational markets can bypass national regulatory restrictions by simply moving the operations elsewhere (Kaufman 2011). Whether water security in the global context is prioritized in the corporate and state-led enterprise agendas depends on the pressure from the investors, initiative of the corporate boards and CEOs or alternatively political will, which again generally depends on strong market signals. However, in imperfect market conditions pressure has to come from the wider network of stakeholders.

When looking at the structural power impacts of the corporations on water security outside the value chains in the wider agro-food network, first, due to their lobbying power affecting agricultural policies and their market dominance the corporations may dictate world market prices making farming unprofitable in some parts of the world and set restrictions to the crops they buy affecting security and diversity of farming livelihoods (e.g. de Schutter 2010; Hendrickson and Heffernan 2002). Second, as the agribusiness giants are also active in banking and financial markets like Goldman Sachs that was recently accused of gambling with hunger in grain price speculation affecting especially African grain markets (Kaufman 2011; The Independent 2nd July 2010; World Development Movement July 2010), the roots of the power of the corporate world over the global water and food security may actually be even deeper in the structures of the international political economy than it first seems. The biggest players reap the profits of the price hikes due to their internal asset flexibility. The poorest farmers cannot afford the farming supply prices of which have risen along the general market trend, poor governments are not able to subsidise imported commodities anymore, the poorest consumers cannot afford their daily bread. The world food system is sliding into increasing food nationalism due to the scarcity induced by population growth, changing consumption patterns, climate change, biofuels boom and unsustainable use of water, the vicious circle stirred by the corporate short-term interests (Brown 2011). It can be argued, that rush for foreign land and water by the rising economic power-player states is challenging the until recently prevailed transnational agro-food power, even *virtual water hegemony*, in the global agro-food system of the global trading corporations (Sojamo *et al.* forthcoming).

A consensus emerged among the interviewees that the growing water security risks may change the dynamics of the agro-food system further emphasizing the role of the transnational corporations and state-led enterprises as powerful bargaining actors both in the value chains and networks and in the global water governance. Ultimately, water security based on the shared risk with other users in the basin will underlie their license to operate.

Finally, when looking at the ideational power sphere and discursive practices of the corporations and the state-led enterprises, it is clear that they are not yet fully aware of their role over global water security and its strategic importance to their actions, even though access to water has been and continues to be the prerequisite for their operations.

Integral to the role of corporations in global water security is a discursive coalition of *risk*. The world's largest food corporations with visible brands among other industry leaders have realised their role as water managers as a consequence of pressure from investors, civil society advocacy groups and to some extent from consumers. The approach is driven by the lead-corporations with visible brands; in their 'story-lines' the focus is on the water scarcity impacts on their value chains, in the physical, regulatory and reputational risks they may face (CERES 2010; Morrison *et al.* 2010). The largest agro-food corporations have started to engage in corporate social responsibility and environmental sustainability discourses only during the past couple of years under the pressure from their value chains and networks. Based on an analysis of the websites and publications of the four largest agro-food corporations undertaken for the purpose of this study, how corporations set (define physical situation for the discourse act and the artefacts brought into it) and stage (organise deliberately the discourse and the symbols used) their discourses is strongly connected to the visibility of their brand and shareholder structure of the company, i.e. their desired position in the value chains and networks and internal corporate governance dynamics (after Hajer and Versteeg 2005b). However, the informative

value given to the other members of their value chains and networks by the corporations of their impact on global water security is still very low.

Without defining the water scarcity or stress of exact locations of their operations by taking in account both blue and green water use, the corporations lose in reliability of their corporate responsibility and accountability. They might be among the most efficient water managers in the world, but without the geographic component in their reporting, sustainability of their operations both in local and global scale is impossible to judge definitely.

Despite the increasing accommodation of water into their strategies, the ideational power of the largest agro-food corporations in global water governance networks relies still mostly on resisting and contesting the emerging discourse coalition around corporations and water security risks. According to the interviews, especially the privately owned Cargill and Louis Dreyfus "do not see water to be an issue to them" and the two corporations are accordingly reluctant to engage in global governance activities around water such as sustainability roundtables and voluntary water accountability programmes. This does not make the corporations inefficient global managers of water as such, but hampers the overall functionality of the governance network under increasing pressure for reform. Reluctance of the largest transnational agro-food corporations to commit to more sustainable framework for value chain governance and trade also enables the high water-risk behaviour of the rising state-led enterprises facing even less stakeholder pressure.

4. Discussion and conclusions

The results of the study have shown that agro-food value chains and networks represent a highly crucial though a complex structure of global water governance. The major role of the largest agro-food corporations and state-led enterprises in global water security builds on their thus far poorly understood power in global water governance networks: on their major share in the international virtual water 'flows' embedded in agricultural commodities, on their strong bargaining position in the agro-food supply chains relying on their global presence and wider influence in the global political economy, and on their partial accommodation and resistance of the global discourses on water.

In principle, major decisions regarding the sustainability of water security reaching from local to global level are made by farmers managing irrigation efficiency with different techniques and water endowments, by traders sourcing from farmers in different parts of the world, by processors branding their products, by retailers setting value standards to their brands, and by the consumers buying the products. However, the consolidated power of the agro-food transnational corporations and state-led enterprises in these value chains and in the wider network of the global political economy makes the decision making setting asymmetric. The power of farmers depends on the agricultural policies of a given country, but the policy is often dictated by the corporate interests. Even in North America farmers can be overridden by the standard setting power of traders forming conglomerates with other food businesses (Hendrickson and Heffernan 2002). Although the power of the educated consumer in the "North" is well documented (e.g. Friedberg 2004; Hartwick 2000), the consumers in the global "South" do not possess such an authority over transnational corporations (e.g. World Development Movement 2010; Friedberg 2007). Furthermore, as the power balance in the world system is increasingly shifting towards Asia, the "East", it is still the global "South" that remains the underdog in food and water

security as its resources are being grabbed by the faster developing economies. The global markets cannot solve the water crisis alone due to this power asymmetry and due to the still prevailing externalization of underlying resource fundamentals in the complex system. Accordingly, the powerful actors of the global agro-food value chains and networks need to be brought under greater stakeholder scrutiny in global governance setting in order to ensure water security ranging from local to global level. General awareness raising on their position is needed among the other actors in the value chains and among the governmental and non-governmental actors in their wider network, who they do still ultimately depend on.

Through their major share of the international virtual water 'flows', both the transnational corporations and the state-led enterprises will likely gain from realising their role as global water managers besides food suppliers and will have to adopt water security as their strategic interest as it ultimately also underlies their license to operate. Even if the corporations kept resisting their role in global water security, pressure for more adequate water reporting and accountability will grow in the future from the agro-food value chains and networks the corporations participate in. How they respond to this pressure will influence investor and buyer decisions. Foreign direct investment in land and water has already aroused such public outcries for example in Madagascar and Philippines that they have led to cancellation of leasing agreements (Brown 2011; World Bank 2010). The foreign investors would benefit themselves from clearer international rules of the game that would ensure shared benefits and water and food security to the locals too.

To conclude, the global water security challenge cannot be solved without the involvement of the currently most powerful actors in global agro-food value chains and networks. Their practices and strategies deserve stark criticism, but the urgency to solve the complex global crises cannot wait for overthrowing the global capitalist system even though the unsustainability of its imperfect market structure has led to the crises themselves. Understanding of the interdependency of the different stakeholders on the shared resources could ultimately force to governance interaction. Corporate water management - like any other form of corporate environmental management - is not just a set of unilateral corporate practices. Eventually it is a political response to stakeholder pressure over water security, vertically in the value chains and horizontally in the wider network governance setting. As entities important to global economy whose whole functionality and license to operate may be at risk due to resource depletion and whose "technological power" could also contribute to more sustainable management reform, corporations could be seen as "regime actors of their own right" (Levy and Newell 2002; Falkner 2004). On the material level the corporations could address resource depletion problems such as water scarcity decreasing their water risks and simultaneously benefit from access to premium markets with their more sustainable products. On the organisational level the corporations could build up alliances with other stakeholders and contribute to the overall horizontal governance architecture and press other members of the vertical chains and networks to adopt more sustainable practices. On the ideational level corporate discourse could create win-win situation for both their business interests and other stakeholders influencing the whole framework for interaction (after Newell and Levy 2006; Gereffi *et al.* 2005; Henderson *et al.* 2002.)

Global standards as a result of roundtable governance interaction are needed for more sustainable water governance in agro-food supply chains and networks. They could include obligation to transnational corporations to also collaborate more with the water management institutions in their

countries of operation, promoting more sustainable practices in regions where the water governance is in a state of disrepair. This "leverage point in value chain governance" has previously been applied in rising labour and environmental standards in the "South" (Humphrey and Schmitz 2001:3). It is acknowledged that enforcing uniform standards into consolidated global value chains risks neglecting local practices and livelihoods and re-materialising post-colonial geography (Friedberg 2007), but in a situation where transnational corporations have a major capacity to ameliorate a fundamental global problem such as water insecurity, their standardized involvement in the global governance of it should be encouraged.

Above all, interaction among the different actors in the agro-food value chains and networks is a prerequisite for a sustainable global water governance framework that demands for obligations from all its participants. Consumers have to be educated on water security to change into less water-intensive diets and to demand for sustainable products. Food processors and retailers have to make consumer decisions easier by developing labelling of their products and demand water accountability from their supply chains. Traders have to respond to the pressure and reconsider the sustainability of their global operations. Farmers need to be encouraged to deploy most sustainable irrigation methods and choose the best crops considering the overall sustainability of their livelihoods. Ultimately, more sustainable agricultural and trade policies and regulatory guidelines taking in account the water-food-energy-trade nexus are needed from the governmental organizations. Non-governmental organizations are needed as general lobbyists and facilitators.

This study does not claim to provide any blueprint for global governance of water security, but to illustrate the thus far poorly understood though highly important role of global agro-food value chains and networks to it. If the multiple global challenges on the water-food-energy-trade nexus are to be solved, more transdisciplinary, solution-seeking research on the topic is direly needed.

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3. SUSTAINABLE CONSUMPTION

HOW TO REVISE THE CONCEPTS OF ECONOMY

Pekka Mäkelä

ABSTRACT – *When taken for granted that we have moved into a society of consumers, as e.g. Baudrillard (2004) and Bauman (2007) have suggested, it follows that we should reconsider the concepts of economy and economics from the point of view of consumption. The essential terms and concepts of economy have their heritage in the early modern era, in the dawn of industrialisation, when it was quite natural to concentrate on the point of view of production as the main aspect of economy and economics. Accelerated ability to produce just about anything implies that we could afford affluence for all humankind if only we could free ourselves from the treadmill of fulfilling the increasing needs we have created to justify and push forward the increasing production, as Galbraith (1969) and Marcuse (1964) stated already more than half a century ago. True, focusing on the rich areas of the world, the growth of production is dislocated, but technically the problem can be solved. To solve today's main dilemmas requires concentration on demand instead of supply. The fate of the production-orientated system now seems to be in the hands of the consumers, i.e. dependent on the willingness of consumers to consume more and more. Consequently, they have become the key agents of society, instead of 'workers' or 'producers'.*

In this paper I will outline some new concepts based on the notion that it is both necessary and possible to invent and create a 'concrete utopia' which doesn't rely on ever continuing economic growth. At first, I want to criticize some of the prevailing notions concerning the supposed empowerment of consumers, the very concept of consumption and the 'imperative' of economical growth, the hidden roots of which are in the consumerist way of living in a society of consumers. Furthermore, before suggesting new concepts, I will introduce Thorstein Veblen's ideas of the dynamics of consumption.

1. Empowerment of consumers as power to exercise choice

In their article "Consumer empowerment: a Foucauldian interpretation" (2006) Shankar, Cherrier & Canniford argue that at the beginning of the 21st century we are in the midst of a shift in power from producers to consumers and this has strengthened the identity of the consumers – as buyers of goods and services. This can be regarded as a liberal-humanistic, traditional and common-sense concept of power and empowerment. People, when conceptualised as consumers, have either been given or they have taken more power, control and influence just as consumers. They are now seen to possess power to get goods and services made according to their desires, to reject non-desired goods, and to shop around for the best price-quality ratio. This consumer power changes the product push approach into a consumption pull strategy and reconfigures the supply chain to the demand chain, which is supposed to

guarantee the consumer's opportunity to get exactly what he or she wants. In the marketing concept, it is approved that people, turned into consumers, are empowered: empowerment thus being equalled with a power to exercise choice. The emphasis on choice goes all the way back to Plato and his aspirations of improvement of the quality of life. (ibid. pp.1013-1015.)

Shankar, Cherrier & Canniford state that neo-classical economics has "provided not only the rationale for perpetual economic growth as a surrogate measure of improving standards of living, but also the intellectual justification for the reliance on markets in structuring the use of resources". Going along the lines of the writers, it can be argued that neo-classical economics hand-in-hand with neo-liberalism has been relocating power to the individuals; more precisely: to the consumers. Inherent in this view is a belief that in the effort to maximise utility consumers know what they want, they just have to decide which product offering – within the limits of their budget – is going to achieve it. Hinting to Slater (1997, p.39), Shankar, Cherrier & Canniford (p.115) propose that consumers are constructed as rational utility maximisers, because rationality and exercise of reason make it possible for people to decide who they are, what they want, what their interests are and how they can best promote them. "These characteristics have become essential to any notion of personal liberty or freedom. This view of consumers is not one that many progressive marketing or consumer behaviour theorists would subscribe to anymore, yet this conceptualisation remains foundational to contemporary political economy".

In line with Shankar, Cherrier & Canniford, it can be argued that exchange economy implies citizens becoming consumers, or being *constructed* as consumers. But, because the consumer has not been given any social identity, asymmetrical power relations between consumers remain without adequate acknowledgement. "This is particularly significant because it leads to markets that favour those who are able to exercise more choice thereby increasing any inherent inequalities that already exist". (Shankar, Cherrier & Canniford 2006, pp.1015-16.)

Like Shankar et al., I dare suspect whether consumer empowerment in terms of manifold choice in the market place could in fact mean real human emancipation, at least in the sense represented by the Frankfurt School. Yet, the new structure–agency composition conceives a potential of radical social change: in the form of increasing purchasing power, citizens of the consumer society have a sort of anti-capital in their possession, albeit dispersed to atomistic individuals who use it in a way damaging to nature, human relations and themselves. Fortunately, this is not a natural law-like, determined way; production can be steered toward a sustaining ground. Through networking, emancipated consumers can, using their possessions differently, turn into a counterforce for major capital – alongside the legitimate procedure of capitalism itself. When enlarging enough, to the point of 'critical mass', this emerging process confuses the conceptualisation of both production and consumption. The actual crisis called precariousness pushes the processes forward while creating a basis for suspicion toward the prevailing values and order. But crisis is only a necessary condition for "questioning of doxa", not a sufficient condition of critical discourse, as Bourdieu (1977, p.169) remarks. What could make them sufficient is one of the aims of my current scrutiny.

2. The concept of consumption is reduced to purchasing power

The concept of consumption is twofold. As e.g. Alan Warde has pointed out in his article *Consumption and the theories of practice* (2005), in reference to Abbott (2001), in its present use 'consumption' is a

'syncretic concept' that reveals the chronic ambivalence between two mutually contradicting meanings, purchase and using-up. Both these meanings have become rooted both in everyday language and scholarly analyses. Warde notes that economists have been "concerned with the terms of exchange", while other social sciences have laid more emphasis on "the symbolic significance and the use of items". The perspective of exchange is, however, dominant in welfare thinking, proceeding from the base notion of exclusivity in the production and distribution of products and services as instrumental to welfare. The serious flaw here is in the exclusion of consumption, in the sense of *using* products, from the economic cycle, even though it is justified to presume that it isn't until there that the final production of welfare begins.

In the concepts of economics consumption has essentially been simplified to mean the using of money. In the sense implied by Simmel (1900), money is an 'abstract item' which has no character by itself but can be converted into any thing or feature on sale. Hence money, in effect, is that which is consumed when buying products or services. Of course products, too, are worn by use, but this wearing down is an (undesirable) side effect of use, and not the aspect that primarily defines it. Adapting Marshall McLuhan, Riihimäki (1991, 22) points out that money is not solely an instrument of economic exchange but also an instrument of economic-social communication. Especially as a research subject in economics the phenomenon of consumption is understood as the purchasing event of the product (and service) which is intended to be used, and not the use itself. Economics and business focus their interest on prices and incomes, i.e. the exchange of products as measured by money, the last stage of which is the consumption purchase.¹

Consumption is left with the role of what could be called the "terminal care" of goods. It tends to be forgotten that purchasing is only a precondition that warrants the right to use a product. (Riihimäki 1996, p.21, 26; see also e.g. Ackerman 1997, p.651.) From a critical viewpoint, it is a question of a model that complies with or steers people's everyday behaviour: buying is consuming and consuming is buying. The consumption culminates in the experience produced by the purchasing event; the product rarely gets a chance to be "completely used-up" before it is already cast aside.

The final goal of the manufacture of products and services is the welfare produced by their *use*. (See e.g. Riihelä & Sullström 2008, p.63). Along with industrialisation and the division of labour, exchange economy surpassed use economy as the defining dynamics of economy. In an exchange economy the use value of goods is largely replaced by their 'ostentatious value' in a public sphere that has turned into a 'spectacle', and welfare is presumed to increase as a function of the use of *purchasing power*, i.e. increased purchases. It is all about the annexation of exchange values to the world of use values, to what Habermas (1968) refers to as *Lebenswelt* (Bauman 2007). This means that newer and newer spheres of life or, rather, human relations, are commercialised in all areas of life, transformed into *pecuniary*. As products are becoming increasingly immaterial along with the New Economy, 'commercial' would lend itself better as an attribute for production than 'material'.

¹ Ackerman 1997, p.651 states that "despite the central role that consumption plays in economic theory, economics has been one of the least affected by new approaches to consumption of any variety."

3. Growth of GDP doesn't guarantee growth in welfare

The volume of purchases has, through the shift of significances, become the measure of welfare. The (economic) welfare of an entire nation is commonly measured by Gross Domestic Product, GDP, which describes the value of the production generated within a country's national borders. The indicator is flawed in terms of measuring actual welfare: itemizing purchases or sales and aggregating the sums of money spent on them don't produce information on what has been achieved with the purchased goods from the point of view of people's welfare (in their own experience).

Welfare measured by GDP is calculated per individual citizen. It is speculatively assumed that the higher the GDP the higher the welfare of a nation (made up of the calculated average of its citizens) and of its individual, theoretical average citizen. Economic growth has thus been set as the universal goal, with the presumption that it will continue without any foreseeable limit. The claims concerning the necessity of economic growth seem however to be based on beliefs that in themselves have been left without sufficient grounds. The concept is used in both everyday speech and economics without reflection and in a propagandist manner, as something positive purely in itself. The rise in GDP contains features that are downright paradoxical, which Riihimäki (2002, p.116), in addition to Baudrillard (2004) and many others, has noted by pointing out that as the market economy becomes totalised we end up having to pay for the water we drink, the peace of nature we enjoy and even the air we breath. The payment is justified by the products' higher degree of processing: "the purifying of polluted drinking water means that water is processed. In today's world, where everything is becoming chargeable, the numbers on growth of GDP give an exaggerated picture of the total wealth." Baudrillard (2004, p.39) uses the term "homeopathic treatment of growth by growth" with reference to the method of calculating GNP ¹in which even the consequences of repairing caused damages is seen to increase welfare – such as, say, a thriving mineral water industry, after the natural water reserve has first been spoiled.

"Now, these compensatory expenditures, whether private or collective, which are intended to cope with dysfunctions rather than increase positive satisfaction, are *added in*, in all the accounts, *as part of the rise in the standard of living*. Not to mention the consumption of drugs, alcohol and the other conspicuous or compensatory expenditure, or the military budgets, etc. All of this is growth and, hence, affluence". (ibid. p.40)

Baudrillard goes on to state that "we are everywhere reaching a point where the dynamic of growth and affluence is becoming circular and generating only wheel-spin and where, increasingly, the system is exhausting itself in its own reproduction." [...] "The only objective result then, is the cancerous growth of figures and balance sheets." (ibid. p40.)

I agree with Riihimäki (2002, p.110) that the basic question of economics on the promotion of economic growth is wrongly formulated, and as Riihimäki (1996, pp.30-31) notes, GDP is a "mutual ranking list of the wealth of the rich western countries", which they started to publish in the days of Cold

¹ GNP (Gross Natural Product) is a "subsidiary concept" for GDP, taking into account foreign income and output. It actually doesn't make much difference which of the concepts is used when speaking of the size or growth of an economy at a general level: the figures correlate with each other strongly.

War. The capacity of GDP to describe the real level of welfare has been questioned with well-reasoned grounds and alternatives are being sought for it¹. The problems of comparability and measurability have however hindered their adoption in national accounting systems.

The idea embedded in the basic concepts of economics of the scarcity of distributable resources helps us to understand the endeavour to continuously increase those resources, because it and it alone is believed to increase the absolute wealth of all citizens. The growth does not however eliminate the scarcity because the battle continues, even in conditions of growth, over the *relative* share of the entire pot to be divided: as part of the population becomes wealthier, others feel more and more impoverished, even if they were becoming richer when measured in absolute terms. The very fact that there is competition speaks of the scarcity of the things that are being competed for. One could say that the more distinctively there is competition in a society, the more strongly it is troubled by scarcity.

4. Veblen's conception of consumption as competition for social status

Where half a century earlier Marx focused on relations of production, Veblen (1899) concentrated his attention on relations of consumption with similar purposes. Veblen wrote his classic *Theory of the Leisure Class* at a time that was already characterised by accelerating economic growth (Robbins, 2008). Veblen envisioned human evolution as advancing from producer to consumer, and he had no faith in the idea that the general increase in wealth would eradicate conflict but seemed instead to believe that development would follow an opposite course. This is ensured by the mutual, imitative or emulative competition causing discord among the consumers, the dynamic of which Veblen (2003, p.23) describes in the following terms:

“In any community where goods are held in severalty it is necessary, in order to ensure his own peace of mind, that an individual should possess as large a portion of goods as others with whom he is accustomed to class himself; and it is extremely gratifying to possess something more than others. But as fast as a person makes new acquisitions, and becomes accustomed to the resulting new standard of wealth, the new standard forthwith ceases to afford appreciably greater satisfaction than the earlier standard did. The tendency in any case is constantly to make the present pecuniary standard the point of departure for a fresh increase of wealth; and this in turn gives rise to a new standard of sufficiency and a new pecuniary classification of one's self as compared with one's neighbours.”²

Veblen sketches a picture tinted with irony on consumption based on ostentation and competition over social status. The idea of consumption as activity that regulates people's mutual relations has not lost its relevance during the past one hundred plus years: purchasing power and wealth is used to obtain social status and ultimately measure human value. The envious, individualist consumer 'unveiled' by Veblen is a creation of modernity and the central agent in contemporary consumer society.

¹ E.g. happiness researcher Layard and economists Hirvonen and Mangelaja (2006) have come to the conclusion that after a certain limit the use of purchasing power has only little influence on the state of happiness.

² http://elegant-technology.com/resource/TOLC_CMP.PDF

Veblen's observation on the interpersonal dependency of human needs is also significant. Many critically minded researchers see people as locked in the position of consumer, where the task of obtaining purchasing power requires more and more work effort of them. Reasons for the lack of momentum for change have been sought in, for example, the institutional structures and practices of consumer society and in the habituation of new forms of consumption. People compulsively "carry along", for structural, social, cultural or economic reasons, practices that define consumption in a field scattered with the traps of fashion, brands, trends and symbols. They feel either powerless to detach from it or have unquestioningly adjusted to the state of affairs they regard as normal, as if they were on an endless journey with no other goal than to keep up with the others. People's need to 'keep up with the Joneses' or 'fit in' has also been seen as a cause for the resistance to change. (Galbraith,1969; Sanne, 2002; Schor, 1998, 1993; Warde, 2005. Ks. myös Southerton, Warde & Hand, 2004; Røpke 1998.)

I see however in the critical discourse on consumption the danger of being stuck at the level of abstractions: for example, the concepts of 'ostentatious' or 'conspicuous' associated with Veblen, as poignantly as they do depict the extreme phenomena of consumption, seem to refer to such a thing as 'consumption *an sich*'. Viewed from a critical, change-oriented perspective, I find the idea proposed by Warde (2005) that various *practices* create different needs to buy and situations and ways of using products more fruitful. It is the very changing of practices that plays a critical part in terms of social change.

'Ostentatious consumption', as described by Veblen, would seem to also aptly refer to the battle over 'social territory' which is being waged at present. In it consumers who are simultaneously concerned about their individuality and about 'belonging in' struggle to 'be seen' as a condition of social survival, as Bauman (2007) describes the predicament today's young people, especially, find themselves in. In this sense affluence and (the connected) purchasing power have become a source of 'social livelihood', after people's basic physiological needs have been fulfilled. Even when a person's material needs have been fulfilled, the 'felt chronic need' is present for reasons such as "the Joneses have a bigger car" or "the Jones boy or girl" has a more conspicuous status in cyberspace.

A social territory is created through private ownership. The amount of private ownership people have varies to large degree. Riihimäki (1996, p.28) writes that aspirations of status provided by private ownership on the one hand and restricting social livelihood to a matter of individual responsibility in the other make up a viscous cycle. He underscores the economic implications of livelihood by stating that "organized, economic insecurity is the dynamic basic principle of our society, in other words, the force that sets people in motion."

5. The Veblen good vs. common good

The term 'Veblen effect', coined by Harvey Leibenstein (1950), an economist who followed in Veblen's footsteps, represents people's need connected with private ownership to do better than others when it comes to the quality, price or conspicuousness or – in a word – desirability of the product owned. 'Veblen good' is an apt term for a thing (be it a physical object such as a property or a car or some other thing that yields status, such as a trip around the world, a certain type of women's high-heeled shoe or a child's school) that the effect concerns as a human relationship-influenced 'disturbing factor' in the theory of demand. The Veblen good is principally all about the illusion in which an object that has status

in the 'spectacle' turns vulgar as soon as a consumer – and all the other consumers – bring it home. But at that point some other object has already shown up to justify the system and call for recognition. (Debord 1967). Aside from there always being some particular dream at the top of the wish list, the flow of products is in a way clustered into brands labelled by trademarks and the consumers are the active commissioners of the 'total of goods' that appear in this manner, as Hernesniemi (2006) points out.

The special conspicuous function of the Veblen good becomes apparent when the 'common good' is viewed alongside it as an alternative phenomenon. A new phenomenon on the Internet is the free, collaborative production of information-based goods. One should however pay attention to the distinction between 'free' as in free of charge and 'free' as in 'independent'. As Lazzarato (2006, p.115) notes, all free software are not independent. The free use of a piece of commercial software increases the user's dependence on the selection of the software produced by the company, while the use of open-source software, even when chargeable, produces the preconditions of its independence. Even if you get a piece of commercial software free of charge, it will bind you to a state of dependence and passivity. (See also Anderson 2009 on the use of 'free' as a marketing strategy).

The 'economy' of free and freely usable common goods can be approached by broadening the scope of the concept: common goods include – besides water, air, nature etc. – the products of 'cooperation between brains'. The latter differ, according to Lazzarato (2006, p.112), from Marx's or Smith's goods produced collaboratively in factories in that they generate *common good*: data, languages, art, services, information and so on. Lazzarato remarks that only goods produced by the capital-labour relationship require private ownership; the reason being that they are eventually destroyed in consumption. Goods produced by the capital-labour relationship can only belong to "me or you". Any attempt to share them further is bound to fail due to their very nature. With common goods the course is the opposite: their value increases when they are shared. A common good cannot be exchanged for anything nor can it be consumed according to the criteria of economics: instead, the exchange of a factory-made good in Marx's and Smith's meaning leads to the satisfaction of a need through the 'destructive consumption' of exchangeable products.

According to Lazzarato, common goods are natural products of cooperation between brains. This cooperation stands in contrast to both Marx's and Smith's productive community, same as how abundance stands in contrast to scarcity, the immeasurable to the measurable, the measure to anything that goes beyond the scale. In Lazzarato's opinion, we should in fact start to think of wealth according to the logic of abundance characteristic of common goods now that scarcity is something created by the justice system rather than a natural condition, as opposed to what economics "as a science of ideal investment of scarce resources" claims. I interpret Lazzarato by remarking that the 'desired change' should centre on the *consumption practices* that represent sociality, whereas Marx stressed cooperation among people as actualised in *production*, and the inherent social nature of man it embodies. (ibid.p.114).

Lazzarato (ibid. p.113) predicted that Marxism and political economics would eventually end up in a crisis: The production of common goods has in present-day capitalism taken up the place that material production had in industrial capitalism, and the latter can no longer be explained through the concepts of productive cooperation. Lazzarato here refers to workers commanded by capitalism. Lazzarato regards common goods (ibid. p.114) as products of the work of the non-state 'public sphere'. This

overriding of the 'interference of public institutions' without the purpose of privatisation renders the classic juxtaposition of private and public void.

I see Lazzarato's ideas on common goods as pivotal in terms of the present practices of consumption. Common goods have a broad *offering*. Connecting with social innovations relating to consumption, the field of design, as an example, could open up in new directions. Many designers see the offering of goods – in its characteristically individualistic and purposefully non-durable nature – as a factor restricting their work. (See e.g. Harni 2010; Heikkilä 2010.) The *demand* for goods that aims to broaden their offering both 'horizontally' and 'vertically' has to however grow significantly before people who earn a living from design could raise the degree of usability of goods through the ideas and means at their disposal.

6. Consumption as production based on economy of use: new concepts

The phenomena of New Economy imply a blurring of the boundaries between production and consumption that has far-fetching consequences. It is a question of earthquake-like movements in social-economic structures of which the overall picture will come out different and cannot be reversed into its original form. As traditional institutions become vague, dissolved or petrified, room is born for new kinds of human coalitions which are not based on membership that is permanent or excludes alternatives. This latent phenomenon is *manifested* at an accelerating pace, impacting both work communities and organisations based on administration, profession or shared interests. As a symptom of precariousness waged work loses many of the features embedded in it in the industrialist era, such as clearly articulated and regular hours and the traditional physical work environment: factory or office required by heavy machinery, and the hierarchical organization its functioning requires. At the same time, waged work itself as an institution has become endangered. The line between production and consumption is also blurred, and an ever growing number of people become dissatisfied with the relic of 'Fordism', work *and* consumption at a forced pace.

I am pointing to certain alternative development paths mainly as formulated by Riihimäki, from the baseline assumption that the number of consumers who are ready to control their desires and needs will keep growing and they will together become conscious of the potential social momentum of their purchasing power. They have at their use an electronic communication network through which they can plan collaborative operations together, such as the funding of jointly approved efforts of people or organizations. This emerging practice is known as 'crowdfunding'. As it expands and deepens, the practice could unsettle the basic assumption of the present social and economic system of humans as individualist maximisers of utility through rational choice.

The task of formulating theories aiming at replacing the macro-level paradigm that emphasizes the necessity of growth calls for a new set of concepts. If the objective is an outline oriented toward new practices, a new kind of praxis, the concepts need to be counterparted with real *opportunity*. (Bloch, 1959; Marcuse, 1964). The anomalies and contradictions revealed in the prevailing reality (or more precisely, the prevailing conception of reality) create room for the conceptualisation of a new reality. The formulation of concepts also has a dimension of power: the prevailing perception of how things really stand has shaped institutions and practices into what they are. (The prevailing perception doesn't usually mean the perception that would best serve the interests of the members of a community.) I have headed the following chapters dealing with the 'agenda' of the network of consumers awakening to a new

consciousness according to the key concepts that they contain, tentatively explicating them (but not defining them, which would require further critical research).

Revising the concept of man: The (ideal-type) conception of the human individual as an exerciser of rational choice, which has spread widely to humanities from new classical economics, has turned any criticism of choice into a taboo: whatever the human individual chooses is rational. Marcuse (1969) called for a 'new theory of man' also as a way of existence: the birth and development of a vital need for freedom, no longer restricted by scarcity or the necessity of alienated work. Riihimäki (2002, p.121) proposes that in order to ascend from the narrow perspective of individual territory to a species or global level we need a new concept of the human individual built on the idea that humanity is both universal and individual. "Restricting livelihood to a matter of individual responsibility means denying the universal human being." This new self-understanding is shaped in close connection with theory and practice, i.e. between new ideas and the activity of testing their impacts.

The two use values of money. Eradicating competition in standard of living requires a new approach to using money (purchasing power). Admitting that the sovereignty of the consumer is only superficial due to the social-pathological distortions in the competition in standard of living helps us to see that money can be spent in a way that questions the reasonableness of the competition itself. According to Riihimäki (2002, p.122), money has, besides its exchange value, also two kinds of *use values*. He calls the use value limited to the purpose of satisfying personal needs 'concrete use value'. 'Abstract use value' in turn is born for money when it is used in a way that questions the reasonableness of the competition in standard of living. *Social surplus value* follows consequentially. It takes on the form of "spiritual reform, empowerment of individuals and human relationships". Using money on the basis of a new *use ethics* would mean investment in the common good, beyond the boundaries of *personal territory*. Such a change of course would have far-reaching consequences: the demand for goods would turn away from status symbols. We would realise that we can get by better, even, with fewer material goods. The change would shake economic life to the core of its very definition and advent an end to the politics of growth of the aggregate economy. (ibid.p.122).

Network consciousness. Riihimäki (2006, p.80) argues that in order to defeat the alienation that marks consumption atomism, the consumer needs a civic movement made up of other likeminded consumers, with a shared *network consciousness* as its underlying force (in distinction from Marx's class consciousness). The model of construction for such a network as proposed by Lazzarato (2006, p.195) lends itself well for this purpose. The transition from micro-level to macro-level or from local to global should not take place through abstracting, universalising or totalising, but by gradually putting together and organising networks and patchworks. Global integration is nothing more than a collection of local integrations: it doesn't presuppose an arrogant attitude.

Two different ways of consumption: Riihimäki (2007) proposes as a strategy for the network of consumers a 'critical praxis' where, instead of consumption and capital, counterpoised are two contrary *ways of consumption*. The prevailing way of consumption is based on an atomist concept of man, which implies a conception of the consumer as a sovereign maximiser of utility through choice. The new way of consumption searches content for a genuine sovereignty of the consumer who is beyond the alienated consumption. The emancipation occurs as people become networked with the objective of freeing themselves from "needless needs". The network of consumers looking to break away from status

consumption has no centre point (or everyone is in the centre point). There is no uniting elite who would do the thinking for the others and set the norms. Hence, there is no hierarchy either.

Consumption wealth as 'countercapital'. The network of consumers awakening to responsibility would begin to be 'woven' by the kind of people who want to actively cut back on the satisfying of needs and desires that they see as unnecessary and burdening to human relationships and humanity's relationship to nature – to give up the 'Veblen good'. These people who would voluntarily restrict their personal consumption would be left with free *consumption capital*, which they would start to invest in some objective that is outside the sphere of their personal consumption. The concentrations of power born in this manner would, in networking together, create 'countercapital' to the production capital, and social initiative would eventually shift into the realm of the consumers.

Creative dimension of consumption. As opposed to the traditional concept of charity, what is essential in this model is the act of joining forces in focusing the chosen projects. This presupposes from the participants an awakening to the kind of network consciousness that would make continuous and coordinated cooperation possible. It is a question of bringing a new, *creative* dimension to consumption, which would at the level of micro-economy increase the psychological and/or material welfare of the participating individual and his circle of affiliates selected on the basis of the investment target. The surplus value for welfare produced in this manner would be actualised without funding from any outside source. Realized interactively, everyone participating in the process would gain in terms of welfare and no one would lose. The principle, if extending to the macro-level, would mean a possibility to disengage this growth of welfare, in its new trajectory, from the demand of continuous growth.

Production based on economy of use. The increase of welfare requires an intensifying of the production of goods based on use value to counterbalance the efforts of the present production model to maximize exchange values. The integrative impacts of this activity on individuals and communities would sooner or later extend to the world of production in a way that would curb private profiteering. This would entail a partial *realignment of production* when some of the old and many of the new companies would concentrate on improving the use-value properties (i.e. offering) of the goods produced. Not only would efforts be made to improve their quality properties in terms of longer lifetime, but common goods would also be produced to be used by several people either in turns or together, alongside goods meant for personal use. This means a (voluntary) separation of *property rights and access rights*, which in turn is only possible in the framework a new use ethics. In a central role in it is the participants' readiness and willingness to care for another person's property as if it were their own. Social investments and innovations could be based on a substitute exchange system such as local currency¹.

Innovations of use. The use of purchasing power and goods guided by a new use ethics would increase use value-based production through innovations of use. Not only would new forms and ways of using products be found for existing goods (e.g. increasing recycling) but 'user-based innovation', which many businesses have started deploy, could also be focused on the use aspect of products, which in turn would have an effect of broadening the offering, i.e. use potential, of goods already in the design and production phases. Generally the endeavour is (according to the bleak characterization by Bauman 2007,

¹ Earlier attempts have largely fallen short in the protectiveness of the state concerning its monopoly of currency. (Douthwaite 1996). For very interesting and extensive perceptions on the different forms and technical realization of local currencies, see Lietaer (2001).

p.21, among others) to get goods out of use as quickly as possible either through rendering them obsolete by manipulating consumer tastes or simply through poor quality. Demand for new kinds of properties would lead, based on the market mechanism, to the manufacturing of products to be durable, multifunctional and capable of serving multiple users. The purchasing of these kinds of products would be investment in broad *use* without the requirement of ownership and conspicuousness that characterises private investments.

Change in the value basis of business. In technology we could thus expect that innovation will be focused on the development of common goods and, on the other hand, hope that innovations of use will broaden the range of users of goods suitable for sharing through consumer or 'user networks'. Processes of change of this kind would also 'loosen' the structure of business organisations; companies would have to rethink their operation and revenue logic from a new perspective – with a consumer-based approach but also taking the changing needs of consumers into account. Consumer behaviour would start to increasingly guide production: marketing, as in persuading consumers to behave in a certain way, would lose momentum and producers would have to comply with a demand constructing itself in a whole new way.

The short-term danger in the process of change as described above is a narrowing of the funding basis of the public economy. A compensatory communal effect can however be found in a novel, alternative use of the 'surplus' of purchasing power, no longer guided by egoistic motives. It is a learning process. Riihimäki surmises that members of consumer networks don't know in advance what the 'right' way to consume is: it is enough that they have reason to suspect the human sense of the prevailing way of consumption. The network is an 'outdoor laboratory' well suited for testing these suspicions. "The guidelines created on the basis of these tests could be called *network therapy*. The network is a platform and process of learning." (Riihimäki, 2007). By building paths that 'regenerate' consciousness and by conceptualising 'models of use' that serve the 'commonness' of goods, we can create a basis for the kind of user-based theories and theory-based practices that, along the lines suggested by Riihimäki, could fall under the collective term of *critical praxis theory*, to differ from the critical theory of the Frankfurt School.

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TOWARDS SUSTAINABLE SOCIETY - TRANSFORMING MATERIALIST CONSUMERISM

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ABSTRACT – *The mankind has faced three regimes: hunter-gatherers, agrarian societies and industrial societies. A transition towards sustainable society will be the next regime. It means a fundamental re-orientation of society and the economy. It is based on knowledge, thinking, value, attitude and behavior change. Finnish university students (n = 198) assessed their attitudes and achievements in implementation of sustainable development in their daily life. The data were collected using a theory-grounded semantic differential technique. A measurement instrument was created by balancing 33 variables of ecological, economic and social sustainability. The variables were indicators of attitudes and behavior. Post-materialistic behavior was operationalized as follows: (a) importance of owning is decreased, (b) services are used instead of owning goods, and (c) renewal of goods is motivated by real needs. Performing of logistic regression analysis found that the difference with the most and less post-materialistic way behaving groups was statistically significant in the following attitudes: health-promoting lifestyle, recycling, organic food, water conservation, maintaining of civil society, favoring the eco-labeled products and using renewable energy resources. These themes are discussed in the paper and a model of sustainability promoting social change is created.*

Keywords: *Sustainable development, consumerism, post-materialism, attitudes, social change*

1. Introduction and Background

Culture of 'having' has been dominating last decades in Finland. It has turned out as consumerism. Perceptions related to means of achieving well-being have hardened in 2009–2011. Ecological values are undermined and the importance of economic growth is argued by citizens to be more essential now than some years ago (Haavisto & Kiljunen, 2011, 131–133). Consuming based carbon dioxide emissions per person in Finland are the highest in Scandinavia and 9th highest in global level (Caldeira & Davies

2010). However, people who prioritize prosperity and goods high are not satisfied to their life (Boyle et al. 2008). Increased opportunities to spend more cause inability to enjoy things obtained with money (Quoidbach et al. 2010). The material prosperity, therefore, might become a barrier to well-being of people living in high consumption society (Bledzki, 2009; Jackson, 2009, 180; Nussbaum, 1995, 90–91).

According to Hofstede et al. (2010, 414, 473) increasing individualism is the biggest cultural change we have faced last decades on the planet. People are more independent than before. They do not need each other to ensure meeting basic needs of the daily life. Individualism associates with own interests and material life goals (Kasser 2011, 207). Mass consumption societies form a global trend. Two-thirds of the world population is currently within a transition from the agrarian to the industrial regime (Haberl et al. 2011).

Citizens of industrialized countries have reached materialistic individualism which poses a threat to the ecological, economic and social sustainability, especially in a long-term period. According to Stiglitz, Sen and Fitoussi (2009, 10) countries that enjoy high living standards are 'robbing future generations'. Munasinghe (2011) and de Zoysa (2011) suggest Millennium Consumption Goals (MCG) to guide Western consumerism. Mass consumption is considered desirable goal, which promotes economic growth. Rarely people try to define how much is enough or how much is too much but instead of this they want to get more.

People justify choices with their values. Values are relatively general appropriate premises, based on needs of individuals and communities (Schwartz, 1992). Economic and safety values are scarcity values. The importance of them tends to increase when threatened, for example during recessions (Inglehart, 1997, 138, Schwartz, 1992). Attitudes are evaluative ratings of the objects (Ajzen, 2005, 4–10). A conceptual difference between values and attitudes is slight.

The importance of material things decrease when people reach more social capital. Quality of life includes factors that are not traded in markets and not captured by monetary measures (Stiglitz, Sen & Fitoussi 2009, 63). These post-materialistic factors emphasize human relationships and the meaningfulness of people's unique lives including trust, community resilience and participation in the life of society (Inglehart 1977 and 2008; Inglehart & Baker 2002; Jackson 2009, 143, 181–182). After all goods and prosperity cannot offer meaning of the life or consolation when life is hard (Jackson 2008, 86).

Inglehart (1977 and 2008) called the re-orientation from materialism to post-materialism 'silent revolution.' It means that quality of life replace materialistic economic and security values. Therefore it indicates change of one's worldview. This paradigmatic shift has described also by Maslow (1954), Allardt (1976) and Schwartz (1992). (Table 1.) Post-materialist values and self-expression values are growing in countries where 'a given generation grows up under conditions that permit it to take survival for granted' (Inglehart 2008, 145).

Table 1. Value shifting (Mikkola 2003, 47)

Maslow (1954)	Physiological needs and safety needs	Social inclusion and needs of love, needs of esteem and achievements
Allardt (1976)	Having	Loving and being
Inglehart (1977)	Materialism	Post-materialism
Schwartz (1992)	Security, conservation, self-enhancement	Universalism, openness to change, self-transcendence

According to Haberl et al. (2011) fundamental thinking, value, attitude and behavior changes are necessary for human survival. We are interested in to find out how this change is possible to reach. We want to know what kinds of attitudes are linked to post-materialistic sustainability promoting behaviour.

2. Material and Methods

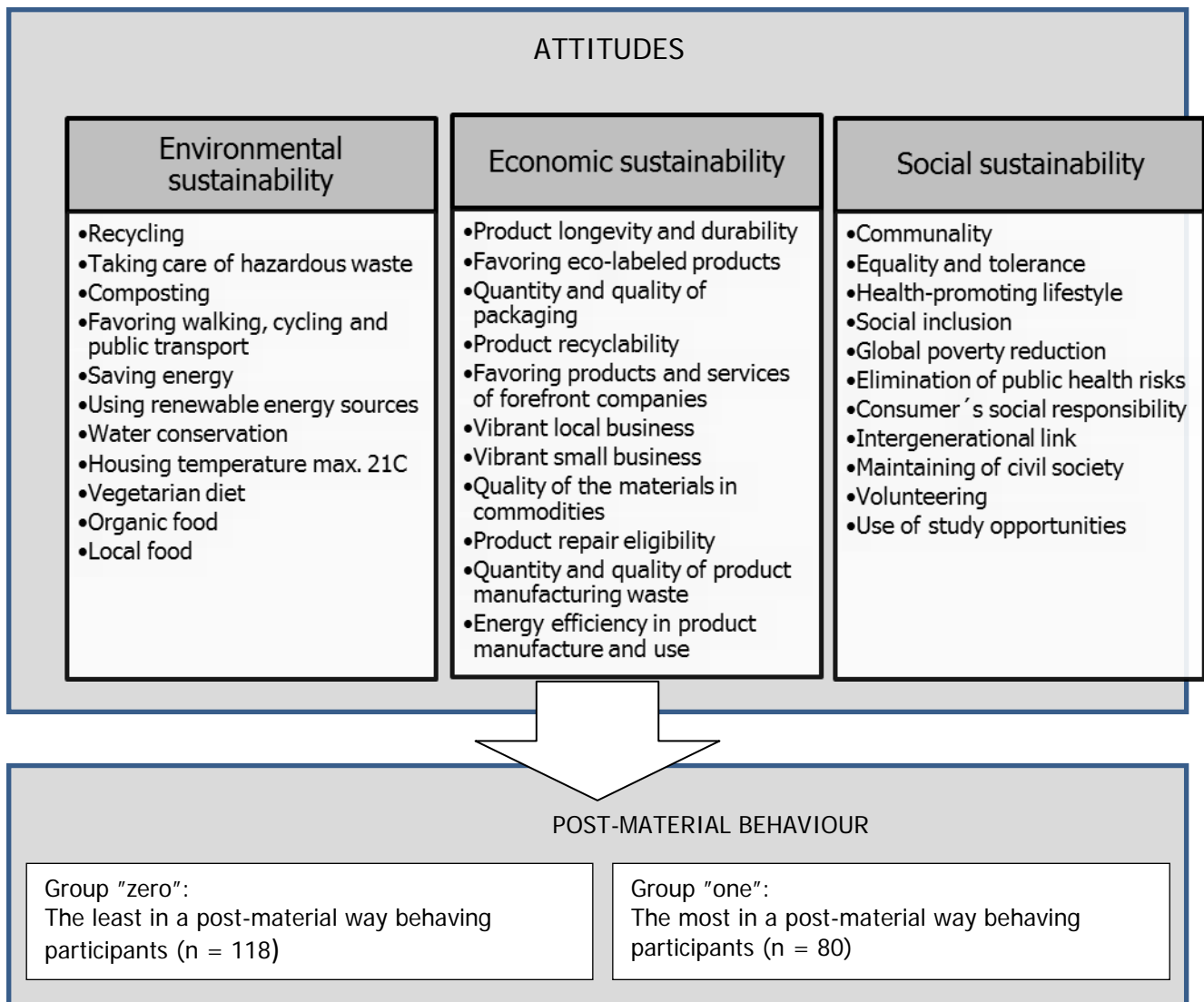
The data were collected on period 2008-2009 using a theory-grounded semantic differential technique (Åhlberg, 1988) that is an improvement of the semantic differential rating scale (Osgood, 1976). Finnish university students (n = 198) from 18 to 40 years old rated statements of sustainability according to their own thinking in their everyday life.

Informants were asked to rate items using the following 9 step scales: (a) value, importance of the item to her/him (no value, not important – extremely important) and (b) behavior - real implementation of the item in her/his life (not at all – always, perfectly).

An outcome post-materialism variable created summing three variables of sustainability. An operationalizing of post-materialism was as follows: (a) Importance of owning is decreased (ecological sustainability) (b) Services are used instead of owning goods (economic sustainability), and (c) Renewal of goods is motivated by real needs (social sustainability). (Table 2). Informants were separated two groups according to arithmetic rating means. Less post-materialistic behaviors created group 'zero' (n = 118) and most post-materialistic behaviors group 'one' (n = 80).

A binary logistic regression performed to see which set of total 33 predictor variables best discriminates two groups of characteristics differentiating informants (outcomes). The 33 variables are based on SD strategies like Agenda 21 Environment and Development Programme (UN, 1992), the European Union Strategy for Sustainable Development (Council of the European Union, 2006), Agenda 21 for the Baltic Sea Region (Baltic 21, 1998), Sustainable Development – New bearings for the Nordic Countries (Nordic Council of Ministers, 2009), and Towards Sustainable Choices – A Nationally and Globally Sustainable Finland (Prime Minister's Office, 2006). Also the following indicators were taken into consideration: Sustainable Society Index (van de Kerk & Manuel 2006), Genuine Progress Indicator (Cobb, Slattery & Talberth, 2007; Lawn, 2003), Ecological Footprint (Wackernagel, 1994), Wellbeing of Nations (Prescott-Allen, 2001), and The Happy Planet Index (Marks et al. 2006).

Table 2. Operationalizing of attitudes (predictor variables) and post-materialistic behavior (outcome variable.)



3. Results

A binary logistic regression was performed to see which set of 33 predicting variables best discriminates the least and most in a post-material way behaving participants. Analysis was performed using the conditional backward elimination model. The final regression model indicated on the 17th step that there were 7 factors that separated the characteristics differentiating informants statistically significant:

1. Health promoting lifestyle, $p \leq 0.000$
2. Recycling, $p \leq 0.000$
3. Organic food, $p \leq 0.000$
4. Water conservation, $p \leq 0.001$
5. Maintaining of civil society, $p \leq 0.014$
6. Favoring eco-labeled products, $p \leq 0.045$
7. Using renewable energy resources, $p \leq 0.100$

The odds ratio of the 7th variable was 1.96. According to Field (2009, 290) a variable with an odds ratio greater than 1 is supposed to take to the model. Cox and Snell pseudo R-square was .53 and Nagelkerke pseudo R-square .71 indicating that the fit of the model to the data was moderate. Classification was good, with 78 % of the post-materialistic informants and 86 % of the less post-materialistic informants correctly predicted.

The set of seven variables covered environmental, social and economic aspects of sustainability. It means that an average Finnish student of social services supposed to be post-materialistic in her/his everyday life if he/she has positive attitudes towards health promoting lifestyle, recycling, organic food, water conservation, maintaining of civil society, favoring eco-labeled products and services, and favoring renewable energy resources. In the following sections we describe the seven attitudinal predictors in the context of sustainability and sustainable society.

4. Discussion

Health-promoting lifestyle. Public health risks can be managed by habits and living conditions. According to long-term follow-up studies vegetarian diet, exercise, moderate alcohol use and nonsmoking can increase life expectancy on average 12–14 years, because these four factors significantly reduce the risks of serious illnesses (Anderson et al. 2011; Li et al. 2011; Fung et al. 2010; Sinha et al. 2009; Taylor et al. 2009; Gu et al. 2010; Khaw et al. 2008; Kvaavik et al. 2010; Norat et al. 2010; Wilkinson & Pickett 2010, 73–75).

A burden of various diseases can also be reduced by quarter if the world's nations managed to reduce greenhouse gas emissions (McKibben, 2010, 72–78; O'Dowd, 2009). It is about global justice because poor people suffer most of climate change (Wheeler, 2011) and 99 percent of people currently dying due to climate change are children (Dara, 2010).

Health and community are interconnected. Social participation provides defense against health-threatening risks (Stansfeldt, 2006; Whitehead & Dahlgren 1991, 12). Human daily life is carried by mutual respect, relationships and trust. Social participation grows in supportive society. Social inclusion is a basic need and a crucial factor of identity. (Deci, 1995, 103; Diener & Seligman, 2004; Max-Neef 1992, 206–207; Michaelson et al. 2009, 3–4; Raatikainen, 2011.) Cooperation increases pleasure, and happiness of people correlates with good relationship and friendship (Cohen et al. 2010; Seligman, 2002). The biggest barrier for the health promoting lifestyle is hurry in daily life (Salonen 2010, 227).

Recycling. From the standpoint of nature consumption is a process with emissions and transferring natural resources to landfills. From the human point of view consumption is a crucial part of material well-being and a base of economic growth. Sustainability takes account the fact that a safe operation base for humanity is limited (Rockström, 2009, 473). Basic metals, for example, run out in a few ten years in the current level of consumption. (Bleichwitz et al. 2009, 8; Jackson 2009, 10).

Recycling means that disposed products, as well as most of wastes, are used as raw material for making new ones. The amount of recycling, composting, and waste can be used as an indicator for

material intensity, which is driven by the thrifty use of natural resources and energy. In eco-efficient society a landfill is a symbol of incorrect process and product design (Salonen 2010).¹

In the nature material and energy is recycling forever. Recycling secures the sufficiency of natural resources, saves energy and decreases emissions from landfills. The need of energy can be reduced by 95 per cent when using recycled aluminum. Plastics, such as product packaging, can be reused for daily commodities such as fleece cloths. (Ackerman et al. 2008; Brown, 2008.)

Organic food. Conventional agriculture is based on use of agricultural chemicals. Chemical residuals in food are related health problems like Parkinson's disease, behavioral disorder such as ADHD, inborn injuries, and child's cognitive development.² Pesticides residuals remain in the human body for 14–16 years. (Bouchard et al. 2010; Engel et al. 2011; Rauh et al. 2011; UT Southwestern Medical Center 2009; Winchester & Huskins 2009.) In addition, there is evidence that agricultural chemicals threaten the entire foundation of world food production and decrease biodiversity (Balmford et al. 2008; BirdLife 2008; Nellemann et al. 2009; Reganold, 2010).³

Organic farming is a good option especially in dry circumstances (Badgley et al. 2007 and 2008; Pretty et al. 2006). de Schutter (2011) argues that small-scale farmers can double food production within 10 years in critical regions by using ecological methods. Organic farming increases community and vitality of country side. It is based on farmers' shared knowledge and skills (Herren 2011, 166; Lobley et al. 2009). It also helps to combat climate change, because it requires less energy than conventional farming which is based on the use of energy intensive fertilizers and pesticides (Wood et al. 2006). Organic farming also absorbs more carbon dioxide than conventional agriculture (LaSalle & Hepperly 2008).⁴

Organic farming integrates ecological, economic and social goals, thus ensuring the principle of multiple benefits. It is also a mechanism to reduce global poverty. Obstacles for favoring organic products in Finland are high costs and availability of the products (Salonen, 2010, 209).

Water conservation. Direct household water consumption is 10 percent of global water consumption (Bergkamp & Sadoff 2008, 133–135). Indirect consumption is much more. Cattle eat an increasing proportion of grain consuming indirectly 70 percent of the total global fresh water (UNEP, 2010).⁵ Global markets for food, goods and services transfer virtual water from country to another. In Britain, for example, hidden virtual water forms two thirds of the water footprint of the country (The Royal Academy of Engineering, 2010, 3, 33).

The direct water use could be reduced by 40 percent in Europe by new technologies, better use of current irrigation methods and abandoning the wasteful use of water in households. Europeans could reduce water usage from the daily average of 150 liters to 80 liters without loss comfortable life. (Dworak

¹A quarter of waste is recycled in Finland. 12 percent of organic waste is composted. Most of it ends to a landfill. (Bistrean, 2011.) Landfills are responsible for approximately 3 percent of greenhouse gas emissions in Finland (Statistic Finland 2010). On a global level landfill emissions are equivalent to the emissions from aviation. (L'Atlas Environnement 2008, 82).

²Prenatal but not postnatal urinary pesticides concentrations were associated with poorer intellectual development in 7-year-old children (Bouchard et al. 2011).

³The world's food production is mainly based on polluted plants. Bees and other pollinators are disrupted by agricultural chemicals. The value of polluting service is about 153 billion per year, representing 9.5 percent of the total global food production value. (Kluser et al. 2010, 4.)

⁴Local organic vegetarian diet decreases 40 percent of consumer's ecological footprint (Frey & Barrett 2006).

⁵In addition livestock produces 18 percent of greenhouse gases on our planet. It is as much as the planet's air, train and car traffic together (FAO 2006).

et al. 2007). In Finland a third of household's energy consumption consists heating of water (Helen, 2008). Pleasure-loving is the most significant obstacle for economical use of water in households in Finland (Salonen, 2010, 225).

Maintaining of civil society. Securing of individual and personal capabilities supports individual freedom and social participation (Sen, 1992; Nussbaum, 1995). Inclusion and cohesion requires an effective and representative local government, strong organizations, participatory planning and access to knowledge, cooperation and partnerships (Roseland & Soots 2007). Modern society is characterized by flexible and aware communities as well as creativity and ability to respond to changing needs (Wilkinson & Pickett, 2010, 270).

Market economy is based on competition between producers. Thinking like an economist undermines community because individuals are looking for financial gain which reduces the attractiveness of cooperation and sharing (Marglin, 2008). However, a strong local economy can represent deep-rooted culture of democracy, where communities are able to take a part to decision making (Shuman, 2010, 11). A major obstacle to fostering of civil society is that citizens feel they are not able to influence in public affairs. Another obstacle is lack of time (Salonen, 2010, 215).

Favoring the eco-labeled products and services. Favoring of eco-labeled products involves a holistic approach. It pays attention to the harms of the product manufacturing and usage. These improvements benefit the company, customer and nature. The eco-label guarantees that products and services consider the environmental and social impacts, which also include health risks for the consumer. Eco-efficient production will not strain the nature with waste. Goods are recyclable or decomposable. A warranty and repairing option ensure the quality and durability of the product. (Auranmaa, 2009; Salminen, 2009; Wilberg, 2009.)

Consumers are ready to pay more for the product if the supply chain is transparent. Supply chain management is particularly difficult in electronics. The challenge is how to consider the complex effects of the metal mining in developing countries, circumstances of employees in manufacturing plants, and the processing of hazardous waste. (Assadourian, 2006, 209; Bleischwitz et al. 2009; Brown, 2008; Edwards, 2005, 128–130; Nordbrand 2009; Schmidt-Bleek, 2000.)

Favoring the use of renewable energy resources. Current methods to produce and consume energy will lead to irreversible changes in the Earth. (IEA, 2008 and 2009). The use of coal has grown globally six years in consecutively even if it is the most polluting source of energy – in Finland the grown was 25 percent in 2010 (Russel, 2009; Statistic Finland, 2011). Fossil energy sources were supported by governments five times more than renewable energy sources in 2010 (IEA 2011). Furthermore coal is often imported from countries which have not ratified the International Labour Organization's agreement on health and safety in mining (Mäkelä & Pöyhönen, 2010).

The way the energy producing is linked to the ecological integrity and safeguarding of biodiversity. It is also linked to democracy, nonviolence and peaceful co-existence of people. Accelerating emissions also promote erosion of land, which is a threat to stable and flourishing societies.¹ They have also impacts to the public health. Europe coal is responsible for .12 deaths from accidents, 25 deaths from pollution and

¹ Climate change has strong negative effects on human health and nutrition (DARA 2010; UNDP 2008; Wheeler 2011).

225 cases of serious illness per terawatt (1,000 billion kilowatt) hour of electricity generated (Markandya & Wilkinson 2007, also Epstein et al. 2011).

5. Conclusions and Limitations

Social change is in the center of sustainability in high consumption societies. It might be more important than a control of population growth.¹ Social change is also possible because there is lot of evidence that life satisfaction does not increase with the growth of wealth after citizen's standard of living meets basic needs such as food, clothing, home, energy and security. As a result material wealth as a goal of life will be abandonment sooner or later. (Boyle et al. 2006; Easterlin, 1974; Kahneman et al. 2006; Nourry, 2008; Raskin et al. 2002; Reker & Woo, 2011; Segal, 1999.)

A structuration of a new social reality starts when habits and practices adopted by the existing structure begin to develop towards different forms of behavior. Importance of a new life style is based on observation of current situation and evaluation of own experiences (Alasuutari, 2007 42–49; Giddens, 1984, 3; Heiskala, 2000, 197). Development is fundamentally an empowering process, and this power can be used to change unsustainable forms of behavior. For example, transforming habits from owning of goods towards the use of services.² Social change starts from personal behavior change and it leads to policy changes (Collier, 2010; Doppelt, 2008).

According to the results of this research transforming of materialistic consumerism is effective when interventions are focused to the presented 7 attitudinal factors. Positive attitudes to these items correlate with post-materialistic behavior. The correlational nature of the attitudinal and behavior factors leaves open the direction of behavior change. Attitude might be a driver of behavior – or – post-materialistic behavior can course particular attitude. The most effective way to transform materialistic consumerism is that interventions are focused on both attitudes and behavior. (Figure 1.)

¹ A child born in Western world put stress on the planet Earth coursing environmental damages as much as 15-150 children born in developing country (Ehrlich & Ehrlich 2004, 115). The richest 20 percentile of the world's population (1.4 billion people) consume over 80% of global output, or 60 times more than the poorest 20 percentile (Munasinghe 2011). World population is projected to reach 9-10 billion in 2050. According to the latest prospects population will be approximately the same in 2100 (Engelman 2009; UN 2011).

² Softer forms of consumerism start to develop when people find a new kind of thinking like 'I do not need a washing machine – I need clean clothes'. Behavior change would be more probably if a new laundry-service is opened nearby at the same time.

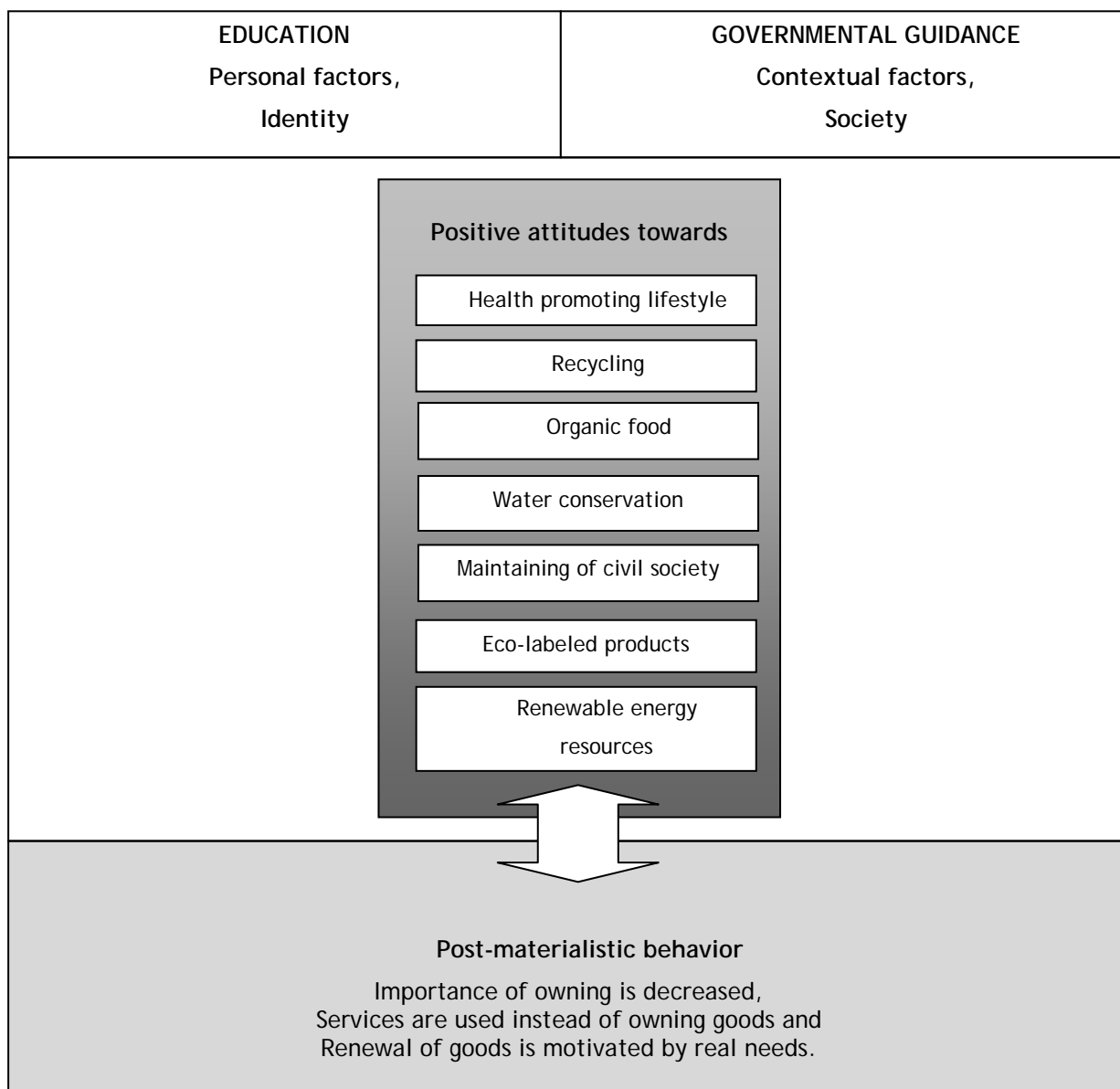


Figure 1. The model of the sustainability promoting social change: structuration of sustainable attitudes and behavior

To see the whole picture it is important to recognize contextual factors of social change. Human behavior is always limited by contextual factors like effective laws and regulations, strong financial incentives and penalties and social pressure (Doppelt, 2008, 69–71; Haberl et al. 2011; Stern, 2005; Schor, 2010). Very often interventions in the context are more effective than targeting individuals with verbal appeals or information to change her/him attitude (Stern, 2005, 10790). Inducements and support of governments are essential for social change because people do not always behave accordance with their attitudes (Jurin & Fortner 2002, 391–392; Salonen, 2010; Uusitalo, 1986). Ethics of everyday choices consists of prioritization of competing factors, conflicting results, and tolerating compromises (Szmigin et al. 2009).

Governments are responsible for contextual factors like infrastructure and regulations. Citizens should have circumstances where diverse life can flourish now and in future (ks. Collier, 2010, 188–189; Jackson 2009). Behavior change is more probably when sustainable choices are easy and cheap to implement. Harmful things should be more expensive than useful things. It is not a good idea, for

instance, to tax labor in the framework of sustainability. (ks. Collier, 2010, 180, 187; Hawken et al. 2010, 164–165). Mainstreaming of sustainability is easier when a price of product includes all the ecological, economic and social costs formed during its life cycle (see Hawken, 2010, 512; Meadows et al. 2004, 280). On the other words: the challenge of sustainable development is how to build society where cheapest products and services are best for people, environment and economy.

We found preconditions for social change towards sustainable society. These factors are in the center of social change when transforming materialistic consumerism in high consumption society. The fastest way towards sustainable society is focusing education and governmental guidance to the same essential factors. In case of organic food, for example, it could mean following things:

- (a) Education: Awareness of health benefits, long lasting soil vitality, strengthening community, low emissions, combatting global poverty and nurturing of biodiversity.¹
- (b) Governmental guidance, policies: Organic farming is attractive business, products are available everywhere, products have competitive prices and there is a strict and transparent control of chemical residuals in food.

The ultimate and fundamental goal for a sustainability research is to determine a safe social and ecological operation base for humanity. We used ‘weak sustainability framework’ which means that environmental, social and economic aspects were equal and balanced in the research – all the dimensions had the same weight. A convergent thinking is essential to avoid a situation where a good but limited solution on one sector is harmful on another sector. Vital ecosystem services are, however, the precondition for mankind's survival and diverse biodiversity is unique and invaluable. Therefore we argue that the ecological aspect is the most important dimension of sustainable development. The sustainable use of biodiversity should be given more attention to.² This means that adopting of ‘strong sustainability framework’ is essential in forthcoming researches. (See Hediger, 1999; Baker, 2006; Ott, 2003.) Differences of the frameworks are demonstrated in Figure 2.

We based our empirical research on well tested research tradition of rating, semantic differential and theory-based differential. The items of the measurement instrument (the items of attitude and behavior) provide stimuli and cues for reflection on sustainability and how to promote it. These 33 variables of sustainable development are transparently available to be evaluated whether any important feature of sustainability is missing.

The performed binary logistic regression analysis emerged the model of post-materialistic and sustainable lifestyle with 7 attitudinal factors. Cox and Snell pseudo R-square was .53 and Nagelkerke pseudo R-square .71 indicating that the fit of the created model to the data was moderate. It means that some unmeasured variables are partly responsible for the observed associations. Identifying of these lacking factors would provide valuable information about promotion of sustainability. The present research is made on thinking, indicated by informant´s ratings. When rating method is used, reasons for

¹ NatureGate (www.naturegate.net) is unique possibility to promote understanding, appreciation and sustainable use of biodiversity in Finland.

² On the other hand the convergent ‘weak sustainable framework’ – which integrates equally environmental, social and economic aspects – is still rare in Finland (Ministry of the Environment 2009, 3).

each rating are left out of the research. In future rating of items should be complemented with interviews and observations.

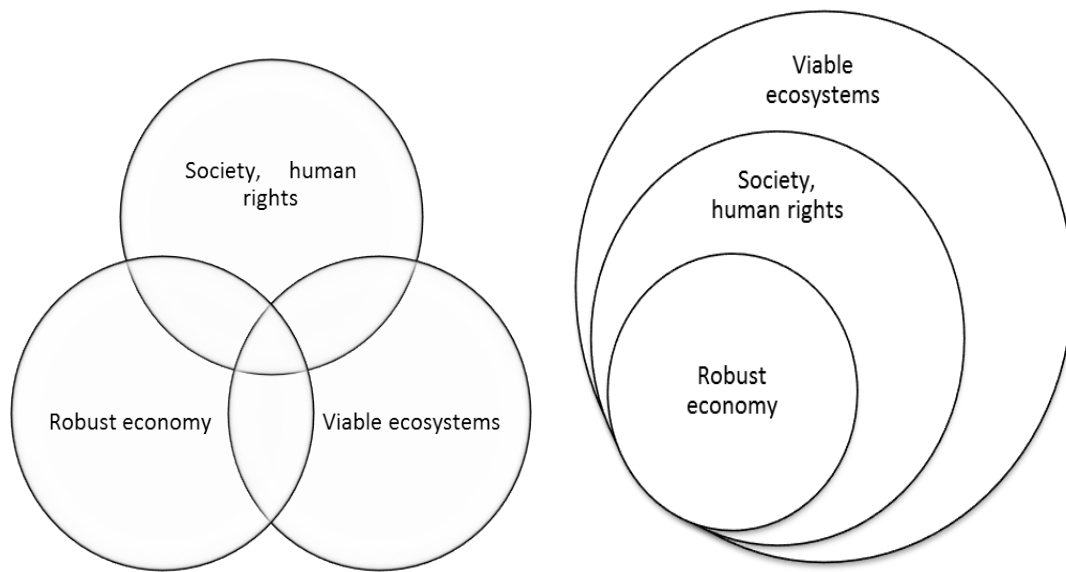


Figure 2. The weak sustainability framework on the left and the strong sustainability framework on the right

In future researches it would be interesting to focus on how people think, feel and act when they argue that they are promoting sustainable development in their everyday life. It would be also good to know what kind of values and attitudes they have and how these factors correlate with each other. Also the quality of the most effective contextual factors would be fruitful information. In practical level the strong sustainability framework means that people have adopted ecosystem centered worldview instead of human centered anthropocentric worldview. This change offers many possibilities for future researches.

The results can be generalized theoretically to 18–40 year old university students living in a high consumption society. Increasing understanding about how they rate and what they think about sustainability is, however, important for all decision makers and on all level of education sector.

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MAXIMUM AND MINIMUM CONSUMPTION

- TWO-DIMENSIONAL APPROACH IN DEFINING A DECENT LIFESTYLE

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***ABSTRACT** – A decent, or sufficient, lifestyle is largely considered an important objective in terms of a sustainable future. However, there can be strongly varying definitions of what a decent lifestyle means. From a socio-economic sustainability point of view, a decent lifestyle can be defined as the minimum level of consumption ensuring an acceptable quality of life. From an ecological sustainability point of view, a decent lifestyle can be defined as a lifestyle that as a maximum consumes an amount of natural resources not exceeding the long-term carrying capacity of nature.*

The paper presents the natural resource consumption calculated for a number of decent lifestyles defined by a consumer panel for people of different age and gender. The natural resource consumption is calculated as material footprint. The results show that the material footprint based on the decent lifestyles is half of that of the average consumer. However, the material footprint is still about three times higher than long-term ecological sustainability would require. The paper discusses this discrepancy and suggests steps for making future lifestyles more sustainable.

1. Introduction

Environmental research about a sustainable future evidently proves that the present level of consumption in Western countries is ecologically unsustainable. In order to reach a sustainable level, from the perspective of natural resources consumption, a roughly tenfold decrease is required (e.g. Schmidt-Bleek, 1993; Schmidt-Bleek, 2009). An ecologically sustainable lifestyle consumes natural resources without exceeding the long-term carrying capacity of nature. In this paper, we call this sustainable consumption level "ecological maximum".

From a social perspective, an “ecological maximum” needs to ensure a decent lifestyle. Socially sustainable consumption emphasizes an equal share in natural resources use and a sufficient quality of life. The environmental concern of limiting the use of natural resources should not lead to an increasing deprivation or a diminishing quality of life. Thus, an ecological maximum has to meet the requirements of a socially sustainable minimum consumption or “decent minimum”. Decent minimum refers to the sufficient level of resources to fulfil needs, participate in society and ensure human dignity (Bradshaw et al., 2008). Hence, we need to clarify what are the products and services included into a decent minimum and how they meet the limitations of an ecological maximum. We will apply a methodology where both aspects of decent lifestyle are concerned (see also Druckman and Jackson, 2010).

In this study we use the decent minimum reference budgets to assess the amount of natural resources required to ensure a decent minimum consumption in the present Finnish society. The natural resource consumption is calculated as material footprint. The results are compared to other studies and to the sustainable level of resource use. The objective of the study is to clarify how close a decent minimum consumption in present Finland is to the maximum ecological limits of consumption? First we shortly discuss the two dimensions of decent lifestyle and different aspects to define the sustainable consumption level.

2. The two dimensions of decent lifestyles

2.1. Socio-economical approach

In the consumer society lifestyle is highly connected to consumption patterns, which from their side represent individual identities and social status. Consumption is related to social processes, like social belonging and individual differentiating and it is one aspect of social stratification. (e.g. Jackson, 2005.) Goods can have various meanings and they are not merely “service-producing machines” but a part of our cultural and personal identity. When new products enter to the market they become an “inherent part of society” (Heiskanen and Pantzar, 1997, 425-426).

As the consumption patterns change over time and in various social contexts, the understanding about the socially acceptable consumption differs from other societies with different goods defined as necessities. To put it simple the “decent minimum” would contain necessities to fulfil physical needs, as drinking water, food, clothes and shelter. However, in the affluent consumer societies like Finland, the decent lifestyle refers to a more complex understanding about consumption and necessities. Essential consumption has become relative, which makes it more challenging to define. (e.g. Soper 2006.) Delimiting the needs and wants is difficult when consumption possibilities tend to increase. New goods enter the market all the time. Good examples of such goods are computers and mobile phones, which are today necessities in socialising and going on many errands.

In this paper a decent lifestyle in socio-economical terms is specified on the basis of the quality, quantity and price of the goods and services required for a decent life. One way to investigate what are the products and services that are presently regarded as a part of the socially acceptable level of living is the reference budget. Reference budget shows what kind of minimum level of consumption is required to guarantee enough resources to fulfil the basic needs, ensure a human dignity and offer sufficient

possibilities to participate in the present society (Bradshaw et al., 2008). These reference budgets describe the level of consumption that has regarded as necessary for all members of society in order to live a decent life (Borgeraas, 1987; Saunders 1998). So, it comprises goods and services needed in everyday life so that a person can 'get by' and his/her life goes smoothly while feeling part of the surrounding society. However, the minimum excludes commodities that are regarded aspirational, not necessary. According to Bradshaw et al. (2008, 3) reference budget is about "fulfilling needs and not wants".

Approaches for choosing what should be included in a reference budget can be classified by whom that is determined. In the recent years studies have been increasingly utilising a consensual method, in which consumers participate in the development of budgets alongside experts in order to detect and better understand the differences in consumption needs in various life situations (Fisher, 2007). The co-operation between consumers and experts develops a consensus-based standard on the commodities a person should be able to afford in the society (Bradshaw et al., 2008). Since the reference budgets take into account the various activities of households they can be utilized, for instance, in counselling situations by public authorities in order to determine the level of social security, or in financial and debt counselling in the planning and monitoring of the clients' subsistence, or in loan negotiations with banks, and in personal finance classes provided by educational institutions.

From an ecological point of view reference budgets ignore the environmental impacts of increasing consumption. Without understanding this connection between consumption and natural resources, social scientist will hold their concern about relative poverty claiming that low-income households have to reach the reasonable level of consumption (e.g. Hirsch et al. 2009) – even though it were ecologically unsustainable. On the other hand, environmental policies introducing cuts in consumption won't be successful if they don't ensure that people are able to live a decent life (Druckman and Jackson 2010). Therefore, both dimensions have to be considered. As the reference budgets illustrate the decent minimum they offer a useful framework to study sustainable consumption. Sustainable consumption should ensure the basic needs for future generations, which means that it should not exceed the ecological limits.

2.2. Ecological approach

The ecosphere produces so called ecosystem services, thus providing us with natural resources – e.g. air, water, land, plants, animals, energy sources and mineral resources. Humans need these "services" of nature to survive and to create the basis of their well-being as well as economic wealth. However, current patterns of production and consumption are threatening this basis by requiring more and more resources and a constantly growing share of our planet's surface. As these problems are complex and global in scope, they involve multi-dimensional cause-effect-impact relationships and time lags (Schmidt-Bleek, 1992; Giljum et al., 2009; Mauser, 2009; Stern, 2007).

If sustainability is to become a reality, a huge increase in absolute resource efficiency is required and dematerialisation needs to take place. One target for sustainable production and consumption has been the reduction of material flows in the industrialised countries by a factor of 10 up to the middle of this century (Schmidt-Bleek, 1993; 2009). This would allow a worldwide cut in material flows by half, while

doubling worldwide prosperity, i.e. it would lead to an increase in worldwide resource productivity by a factor of four (von Weizsäcker et al., 1997).

According to Bringezu (2009) an acceptable level of total material consumption¹ would be appr. 6 tonnes of abiotic materials per capita in a year. In addition, the present consumption of appr. 4 tonnes of biotic resources could probably be maintained, whereas erosion should be reduced by a factor of 10 to 15 from the present 3 tonnes per capita (Bringezu 2009). Thus, a sustainable level of total material consumption would amount to a maximum of 10 tonnes, including household consumption as well as public consumption and capital formation. This means a reduction by a factor of 3 to 8.5 from the present TMC level of Western industrialised countries according to Bringezu et al. (2009) and a factor 5 to 6 reduction of the Finnish TMC according to Hoffrén (2010), Bringezu et al. (2009) and Mäenpää (2005).

Concern about unsustainable development of private consumption has raised its head during the past few decades in the western countries. Household consumption has grown tremendously: the consumption expenditure in the EU-15 increased by almost one third per person between 1990 and 2002. At the same time households are becoming smaller and are tending to use more energy and water, in addition to generating more waste per person (European Environment Agency, 2005). By the year 2030 the world GDP is expected to grow by 130%, which means that the extraction of natural raw materials would increase by 50%, despite an expected improvement in efficiency (Meyer, 2009).

The FIN-MIPS Households research project has calculated the material footprint of 27 Finnish households in an explorative setting. The average material footprint of the households studied was 39 tonnes per person in a year, which is very close to the 40 tonnes of an average Finn (Kotakorpi et al., 2008). Thus, an average Finnish household would have to achieve a reduction by a factor of 5 to 8 in order to achieve the sustainable level of natural resource consumption sketched above on the basis of Bringezu (2009), depending the level of resource consumption from public consumption and capital formation that could be considered sustainable.

3. Methods

3.1. Reference budgets

The National Consumer Research Centre (NCRC) compiled the decent minimum reference budgets (Lehtinen et al., 2011) as part of the comprehensive research project 'Back to basics: Basic security and consumption'². The decent minimum reference budgets were produced for four types of households: a young single person, an elderly single person, a middle-aged couple, and a couple with two children (Lehtinen et al., 2011).

In the NCRC's project, groups of consumers, experts, and researchers were involved. Discussions about commodities were conducted with the consumers (n=53) but the commodities included in the

¹ Total material consumption (TMC) means the consumption-based material consumption of an economy, i.e. the total material requirement (TMR) of an economy minus the export-based resource use. Both TMC and TMR include the consumption of abiotic and biotic resources as well as erosion in agriculture and forestry.

² This project examines the level of Finnish basic security from various perspectives and is performed by the Social Insurance Institution of Finland, Kela, the National Consumer Research Centre, Helsinki University, and the National Institute for Health and Welfare.

budgets were mostly selected by experts. The consumers were selected from the household types the reference budgets were targeting at. Previous studies show that consumers are best equipped for preparing a budget for a household type resembling their own, since they are familiar with its special characteristics and requirements (see Hirsch et al. 2009; Warnaar and Luten 2009). Each consumer took part in three group discussions and completed homework assignments. Five of the discussion groups convened in the Helsinki metropolitan region, one in Oulu, and one in Joensuu.

Before determining the commodity basket, the level of the desired budget was decided. In the reference budget project, the objective was a budget for a decent minimum standard of living, which is more than sufficiency minimum. The content of the reference budgets concretized the descriptions of expenses derived from consumer choices. When choosing the commodities, compromises were made in terms of products, prices, quality, life span, and the needs of each member of the household.

The reference budgets include only expenses the consumers pay by themselves. Services (e.g. school meals) and financial support (e.g. housing allowance) provided by society were not included. The budget contains the following product and service groups: food, clothing and footwear, household appliances, entertainment electronics, ICT, health and personal care, leisure, participation, transport, and housing. Total expenses are calculated for the periods of one month and one year. In addition to this, the budgets included a stock of goods and appliances including service time estimates for each individual item.

Table 1 gives a summary of the results of the decent minimum reference budgets defined. For reasons of illustration the budgets in table 1 are displayed in euros per month. Every individual needs own food and clothes but most of the other goods can be shared with other household members. That's why single person's budget is relatively high compared to households including several members. Regional differences are very high in housing and transport costs. Also, those two groups are linked together. In the table 1 the cost are compiled in Helsinki (see table 1).

Table 1. Reference budgets for three types of households (Lehtinen et al. 2011)

	Single female under 45, €/month	Couple, €/month	Family with 2 children, €/month
Food	283 €	518 €	815 €
Clothing, electronics, appliances, household objects, newspapers, telecommunication, etc.	185 €	262 €	432 €
Electricity	16 €	22 €	34 €
Home insurance	6 €	8 €	19 €
Leisure equipment, hobbies, holiday travel	34 €	62 €	89 €
Health (medicine, accessories, medical services)	22 €	31 €	39 €
Personal hygiene	37 €	54 €	69 €
Total, €/month, excl. housing and transport	583 €	957 €	1,497 €
Housing (apartment size)	45 m ²	75 m ²	92 m ²
Housing (rent in Helsinki)	654 €	1,091 €	1,338 €
Mobility (Helsinki public transport system, bicycle, 1 car in family)	45 €	90 €	660 €

3.2. Material Footprint

The natural resource consumption of the decent reference minimum budgets was calculated as material footprint (see Lettenmeier et al., 2009). The material footprint is based on the MIPS concept that has proved to function as a holistic, useful, reliable and understandable measure for natural resource consumption, thus serving also as a central indicator for ecological sustainability (e.g. Schmidt-Bleek, 2003; 2009; Rohn et al., 2010). The method considers the whole life cycle of products and activities and includes direct resource use (used extraction) as well as indirect resource use (unused extraction, see Gliljum et al., 2009; Aachener Stiftung, 2010). In this paper, the resource consumption is given in mass units of TMR (total material requirement, i.e. the sum of abiotic and biotic resource consumption plus the top soil erosion in agriculture and forestry, see Ritthoff et al., 2002).

The calculation of the natural resource consumption of the decent minimum reference budgets was done on the basis of the yearly consumption of the households defined. Food was integrated on a two weeks' diet basis defined by the consumers (see section 4.1). Household objects and appliances were calculated on a stock basis including service life estimations, both defined by the consumer panel.

Material footprint calculation is done by multiplying the direct resource consumption or other input (e.g. electricity or transportation) with a material intensity factor specific for each input (see Lettenmeier et al., 2009). Most of the material intensity factors used for calculation the material footprints were taken from Kotakorpi et al. (2008), Lähteenoja et al. (2006) and Lettenmeier et al. (2009). In addition, some coefficients, e.g. for health care and hairdressing, were calculated in this study. In some cases (e.g. daily mobility by public transport) the decent minimum reference budgets were not sufficient for calculating resource consumption. In these cases, statistics and literature-based estimations were used, e.g. data from the National Travel Survey (WSP LT Consultants, 2006) to estimate transport distances.

4. Results: The material footprint of the decent minimum reference budgets

The material footprint of all decent minimum reference budgets is appr. 20 tonnes per person in a year (Figure 1). The family has the highest material footprint per person (23.6 tonnes per year) and the woman under 45 years of age the lowest (19.8 tonnes per year). Thus, the material footprint of all decent minimum reference budgets is roughly half of the one of an average Finn according to Kotakorpi et al. (2008).

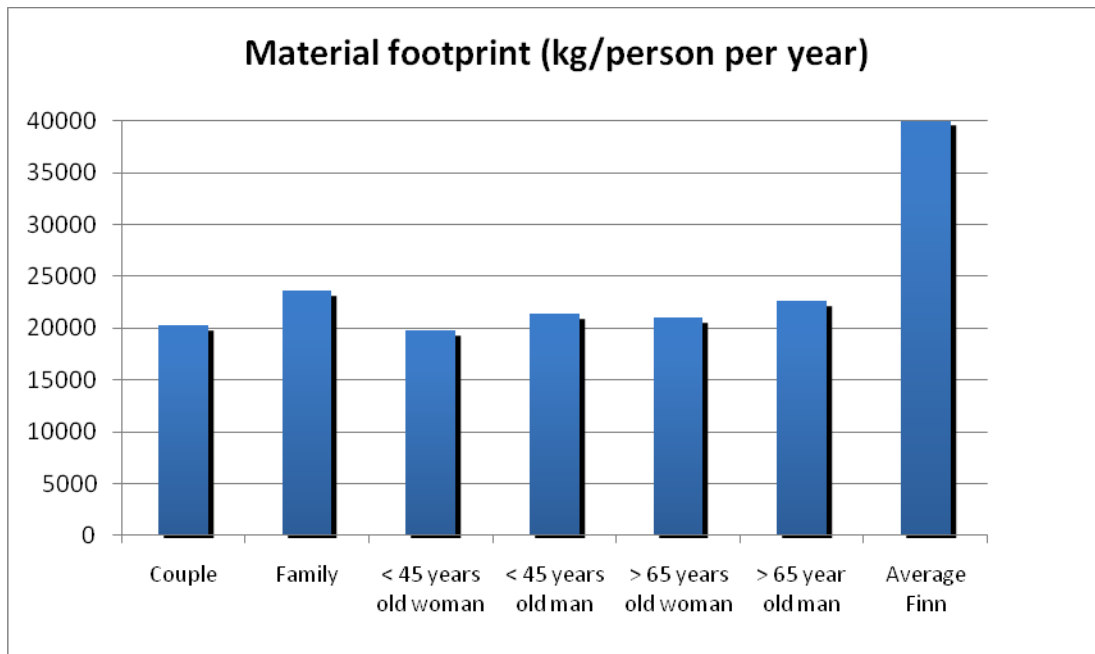


Figure 1. Material footprint of the decent minimum reference budgets and an average Finn.

When the different consumption components are displayed separately (Figure 2), housing is the most relevant sector, followed by food and leisure/tourism. However, in the case of the family the material footprint of daily mobility is seven times greater than with the other household types and dominates the material footprint in total.

Housing, which includes the building, its heating and the electricity consumption of the household, is by far the most resource-consuming consumption component with the single household. Also in the case of the couple it is the most-consuming component. According to the decent minimum reference budgets, the living space per person is decreasing with a growing amount of inhabitants. This explains why the family with children has a smaller material footprint per person for housing.

There are several opportunities to spend leisure time. The reference budgets include only one physical activity with the equipment and fees it requires, cheap cultural activities, some trips to meet friends and relatives living in other parts of Finland, and one cheap holiday trip e.g. to Tallinn (Lehtinen et al. 2011).

The production of household equipment, clothes, daily consumer goods, newspapers and services consumed by the decent minimum reference budget households play a relatively small role.

As mentioned before, the decent minimum reference budget of the four-person family consumes the highest amount of natural resources per person. Although their material footprint for housing is smaller than with the other types of households, they have a sevenfold material footprint for daily mobility in comparison to the others. This is due to the assumption of the consumer panel that the decent minimum reference budget of a family should include a car whereas the other households are supposed to use public transport and bicycles only. The car of the family causes 8.4 tonnes of material footprint per person, which is 37 % of the family's material footprint in total.

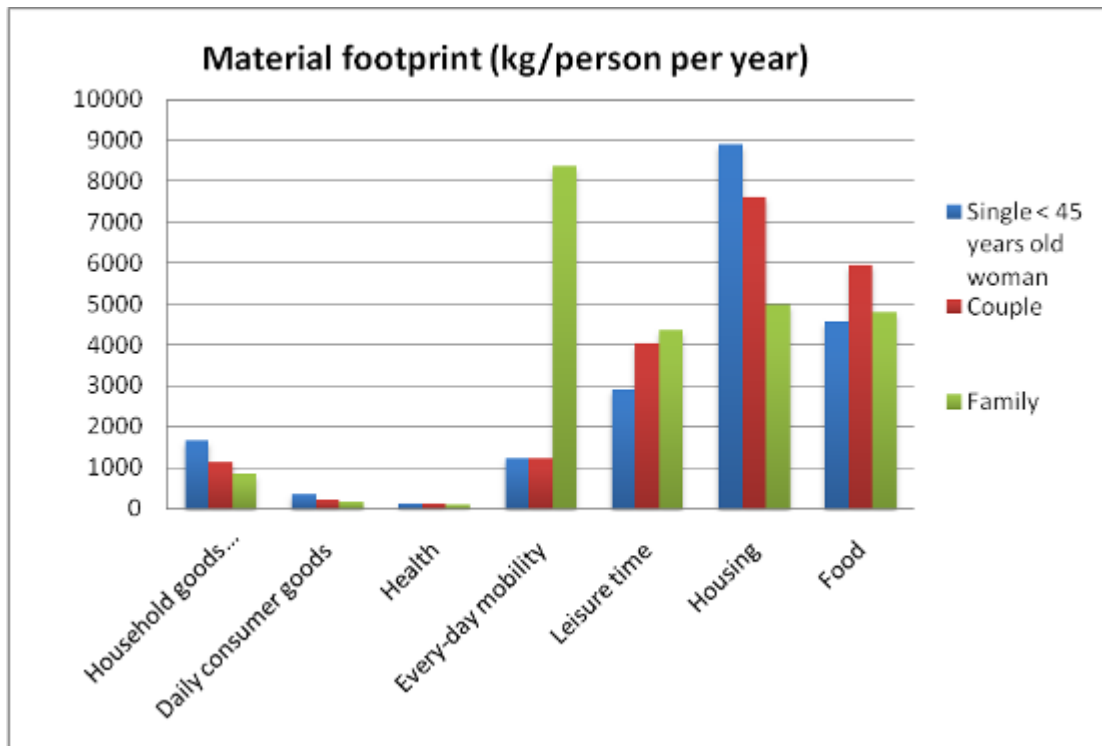


Figure 2. *Material footprint in the different consumption components of three decent minimum reference budgets.*

5. Discussion and conclusions

When the decent minimum reference budgets are compared to the households studied by Kotakorpi et al. (2008), their material footprint per person per year is relatively low. In Kotakorpi et al. (2008) only seven out of 27 household studied have a material footprint of 20 tonnes or lower and there are six households with a material footprint of more than 50 tonnes per person.

Out of the decent minimum reference budgets, the family has the greatest material footprint per person (23.6 tonnes). This differs from the results of Kotakorpi et al. (2008) where families tend to have smaller material footprints than single or couple households. The reason is that the consumer panel assumed that the decent minimum reference budget of a family should include a car whereas the other households are supposed to be car-free. The use of the car raises the material footprint of both daily mobility and leisure time (incl. tourism) above the level of the other household types.

The reference budgets describing the socio-economical minimum illustrate the level of consumption that allows a household to fulfil all basic needs and participate in society. The material footprint due to the decent minimum reference budget is approximately half of that of an average Finn. This means that the present average material footprint of households can be halved while still keeping the possibility of achieving a decent lifestyle. This is a remarkable potential for making consumption more sustainable.

In order to operationalize the potential for decreasing the material footprint, one must have a closer look at the different consumption components. Housing is the most resource-consuming consumption component of the decent minimum reference budgets (despite in the family reference budget). This is due to the fact that housing always needs some infrastructure and as the private living space was regarded as an important part of decent housing the amount of living space is relatively high in the

reference budgets. A reduction in living space per capita, longer-lasting and less resource-intensive houses and a decrease in energy consumption could reduce the material footprint of housing. However, the officials' discussion on living space still tends to suggest an increase of average living space instead of a decrease. Authorities and municipalities should realise that the increase in square metres happening so far does not represent a sustainable trend. Step by step reductions in the amount of living space should gain social acceptance. Otherwise long-term sustainability targets will be hard to meet.

Nutrition is a basic need that can be reduced only up to a certain point. So far, the material footprints for nutrition of the decent minimum reference budgets are making up approximately half of the sustainable maximum. However, there are still potentials in the food chain for reducing resource consumption, e.g. by developing and adopting radically less animal-based diets and by reducing food waste in production and consumption. Hence, taking into account future improvements potential a sustainable level of resource use for nutrition seems, in principle, achievable.

The material footprint caused by everyday mobility in the decent minimum reference budgets seems to fit relatively well into the ecological maximum as long as it is based on short distance public and bicycle transport. In the case of the family using their own car the value rises sevenfold to the magnitude of the ecological maximum in total. Thus, the present infrastructure-intensive, private-car-based mobility system does not seem to fit into a sustainable future. In order to adapt mobility to a sustainable future, car-free lifestyles and neighbourhoods should be promoted and experiments created by municipalities and other authorities as well as business and the consumers themselves. One prerequisite for this would be a sufficiently dense network of services like shops and leisure venues in order to decrease daily mobility distances.

Although the material footprint of the decent minimum reference budgets is only half of the average material footprint of Finns, it is still about three times higher than the long-term sustainable maximum. This means that a sustainable level of resource use cannot be achieved solely by consumer choices and activities but states, municipalities and companies must improve the conditions and technologies enabling households to consume in a more sustainable way. This includes the need for incremental as well as radical changes in order to facilitate sustainable lifestyles. As there are still nearly 40 years to go until 2050, there is still plenty of time for implementing these changes and lifestyles. However, planning and innovating the way towards the sustainable future should be started immediately.

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4. SUSTAINABILITY AND THE SOCIETY

A CONCEPTUAL FRAMEWORK FOR LIFE CYCLE THINKING IN TRANSITIONS TOWARD SUSTAINABLE WASTE MANAGEMENT

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ABSTRACT – *As society continues its pursuit of sustainable development the importance of resource efficiency and waste management has become increasingly recognised. As a consequence, a number of European policies implement the concept of life cycle thinking in order to reduce the negative environmental impact of waste management systems. The benefit of life cycle thinking is that its holistic perspective allows one to account for the environmental impacts or benefits of not only the waste system but connected systems - such as energy and material production. However, the current use of life cycle thinking in long-term waste management strategy has been called into question regarding its ability to facilitate a transition toward sustainable waste management.*

This paper presents a conceptual framework for the use of life cycle thinking as an element in sustainability transitions. It draws on transition theory and the concept of conventional regimes (economics of conventions) in order to provide a new perspective on the relationship between life cycle thinking and sustainable waste management.

1. Introduction

The linear flow of resources through society is hardly a sustainable practice. The negative environmental and health impacts associated with the treatment and management of waste represent a burden to both society and the environment. Although waste is essentially a result of production and consumption patterns, the socio-technical systems that exist to manage this waste require change if the efficient and effective use of waste as a resource is to be achieved. In this context, the vision of a 'recycling society' has been established at the European level as a normative long-term vision for future waste management systems (European Commission 2005a). At the same time, the European Commission (EC) has referred to life cycle thinking (LCT) as a key concept to be incorporated into national waste policy and strategy – this aims to reduce the negative environmental impacts of waste and resource management (European

Commission 2005a). LCT is a concept¹ which seeks to identify potential improvements to goods and services in the form of lower environmental impacts and reduced resource use throughout all life cycle stages (European Commission 2010). Although the holistic view provided by the life cycle approach is generally accepted as “*the “right” and “obvious” way to deal with environmental issues*” (Heiskanen 2000a, 42), the current implementation of LCT in terms of policy and long-term strategy, especially at the European level, may not necessarily guide waste management regimes toward a ‘recycling society’.

This paper aims to make progress in understanding how LCT can be used to aid the coordination of a transition toward sustainable waste management. This paper presents an initial attempt to construct a conceptual framework drawing on transition theory and the concept of conventional regimes in order to give a new perspective on the relationship between LCT and sustainable waste management. In this context, we suggest integrating LCT as an element in the transition toward a ‘recycling society’. This entails its use as a tool to test the legitimacy of waste hierarchy² as a waste management principle, and in the eco-design of system innovations in order to assist in the development of a technological trajectory of ascending the levels of the waste hierarchy.

2. Theoretical considerations

2.1. Transition management - guiding action toward a normative long-term goal

Transitions are structural societal changes resulting from economic, cultural, technological, institutional and environmental developments, which both influence and strengthen each other - usually taking place over a period of 25-50 years (Rotmans 2005). Transition management “... *is concerned with the functioning of the variation-selection-reproduction process: creating variety informed by visions of the sustainability, creating new paths, and reflectively adapting institutional frameworks and regimes*” (Kemp and Zendel 2007, 27). The goal of transition management for sustainability is to orient socio-technical and political dynamics to sustainability goals chosen by society (Kemp and Loorbach 2003). Kemp and Loorbach (2003) propose that the transition process starts with the creation of a long-term goal in response to a problem. An example is the sustainable use of resources due to resource scarcity and increasing consumption. Subsequently, the creation of a guiding normative vision is useful for mobilising actors and helps to serve as the basis for coordination in achieving a long-term goal. Indeed there may be multiple guiding visions and multiple transition paths for each vision (Kemp and Loorbach 2003). Transition paths are routes toward the final image. These transition paths incorporate interim goals and objectives which evolve and become more concrete the closer they are to the present (Kemp and Loorbach 2003). These guiding visions, transition paths and practical experiments (which explore transition paths) form a transition agenda.

¹Encompassing: (1) life cycle assessment (LCA): the analytical tool used to compile and evaluate the inputs, outputs and potential environmental impacts of a product/service system, and (2) life cycle management (LCM): a business management concept based on life cycle considerations, used in the development and application of sustainability strategies (European Commission 2010).

² Prevention, before reuse, before recycling, before energy recovery and disposal as a last resort.

Geels notes that for transitions to occur, the socio-technical regime - the “*deep-structure’ or grammar of ST-systems*” (Geels 2004, 905) linked together by semi-coherent sets of rules (Geels 2004) – requires change. Building on science and technology studies (STS), evolutionary economics, structuration theory and neo-institutional theory, an understanding of the role of rules and institutions is explicated modifying Barley and Tolbert’s (1997) recursive diachronic model of structural change and reproduction (Geels and Schot 2010). Neo-institutional theory is used in order to overcome the lack of agency¹ in evolutionary approaches. However, one can still find themselves in an evolutionary approach considering the adoption of rules is the result from a somewhat unexplained “community selection” (Geels and Schot, 2010:51). The fact that rules are related to actors games and to power relationship between actors (which does not mean that the result, the adopted rule, is exactly or even broadly what actors intended to achieve) is therefore uninformative in this approach.

2.2. Conventional regimes - conventions guiding the coordination of action

In relation to modes of coordination aiding in the transition toward sustainability, the *economics of conventions* and the concept of conventional regimes may allow us to better understand how actors coordinate their action, and how the concept of LCT may be used in the coordination of action toward sustainable waste management.

Conventions are collective agreements, tacit or explicit, which allow agents to coordinate their activities (Boyer and Orléan 1994). These agreements concern the validity of several values, rules, norms and ways to behave in society that guide interaction. These values, rules, norms and behaviours are conventional in the sense that no scientific evidence exists in order to explain the choice of one convention over another (Buclet 2011). At a strategic level, Sugden (1989) highlights two salient properties of conventions: (1) they are self-reinforcing in the sense that each agent abides by certain conventions when he expects others to abide by the same convention, and (2) they are evolutionary stable strategies in a game of at least two actors, whereby in the case of one or more strategies, if one strategy is followed by the majority of agents, it cannot be evicted by other strategies. Even if a competing rule or strategy is more efficient from the perspective of coordination, it is unlikely that this rule or strategy will replace the existing convention.

Buclet (2011) expands on this notion of convention to include not just *rules* but *principles* and *values* that coordinate social interaction and form the basis for coordination in a regime. Buclet (2011, 66-67) defines a conventional regime as corresponding to a “*moment in time and space during which a given human community is behaving according to several principles which orient individuals’ behaviours within the community. ... These principles which are of a conventional nature, rest on the shared values of individuals composing the community*”. The notion of *conventional nature* is required to explicitly demonstrate that these values and principles are not naturally defined - neither inherent to human behaviour nor complex societies (Buclet 2011). Conventional principles are reified by

¹“Agency in the transformation of socio-technical regimes is the ability to intervene and alter the balance of selection pressures or adaptive capacity” (Smith et al. 2005, 1503)

conventional objects¹ (technical objects whose way of being used depends on conventional principles) which translate these conventional principles into tangible references for every day actors. In the steadiest cases of conventional regimes, principles are *naturalised* by the way actors represent to themselves how a human society is working and *should*, in any case, work. When referring to these conventional objects, each actor will reduce the uncertainty of future interaction resulting in two primary benefits: (1) decreased uncertainty as to the behaviour of others increases the capability to act according to these objects, and (2) the possibility for collective actions are increased at the societal level (Buclet 2011). Both principles and objects are *reference points* promoting the coordination of action.

Conventional regimes are built on a number of conventional principles and values. Regime stability results from the conventional nature of the principles and values which coordinate individual and collective action within the socio-technical system. How do conventional regimes evolve? Regimes are regularly submitted to moments where the conventional principles are challenged. In that case they might (1) not be affected by those challenges and therefore reinforced, (2) be affected by challenges but be able to evolve through more or less an important modification of the way conventional objects are being used and the way conventional principles are interpreted, or (3) be severely affected by challenges and therefore weakened. Principles may be replaced and, in that case, regimes are strongly modified or replaced by a more efficient (or consensual) regime. Boltanski and Thévenot (1991) provide an elaborate framework for the justification of arguments in such tests of legitimacy.

3. Previous waste management transitions in Europe

3.1. Waste management transitions in Europe

Recently, several studies have been undertaken on waste management transitions (Loorbach 2007; Parto et al. 2007; Raven 2007; Kemp 2007; Kemp et al. 2007; Geels and Kemp 2007), fulfilling the role of case studies illustrating conceptual developments in transition theory. Likewise, previous studies have been undertaken from the perspective of the economics of conventions in order to understand the evolution of conventional waste management regimes in Europe (Buclet and Godard 2000; Buclet 2002).

Parto et al. (2007), based in transition theory, highlight two previous waste management transitions in Holland² which have occurred since the turn of the 20th century. The first, which is said to have its origins in the mid 19th century having stabilised between 1920 and 1960, and a second which commenced in the early 1970s and which has stabilised by the mid 1990s. The first transition is broadly characterised by the transition from ‘unregulated handling’ to ‘centralised systems’ for disposal, whilst the second transition showed a move from the ‘centralised disposal’ of waste to ‘waste management’ (See Parto et al. (2007) for a detailed description of these transitions).

¹ Such as the colour coded system for waste disposal in Germany (blue – paper, yellow – packaging, brown – organic)

² Which can be reasonably translated to waste management transitions typical of Northern European countries.

Hafkamp (2002), working from the economics of conventions, also detailed two such transitions at the European level (based on case studies from Germany, the Netherlands, France, Italy and Greece). The first, from the 'old' regime based on the protection of public health, from the mid 19th century to the end of the 1960s, and the second, an emerging 'new' regime based on prevention and closed material cycles, from the early 1970 to the end of the 1990s.

These authors note that European waste management may be on the cusp of a new transition, indicated by events that have occurred during the late 1990s/early 2000s. For instance, less formal involvement by governments at the national level (Parto et al. 2007), friction between member state regimes (Hafkamp 2002) and the changing perception of waste.

3.2. Changes in institutions/conventions responsible for change in waste management regimes

Both transition theory and the economics of conventions look to explain regime change through the change in the existing structure of rule/institutions/conventions which guide individual and collective action. Parto et al (2007) use institutions (behavioural, cognitive, associative, regulative and constitutive) to understand a series of innovations in the Dutch waste system. Hafkamp (2002) identified several conventional principles of the 'old' waste management regime, namely: "*the municipality collects the waste; disposal without risk to public health; costs borne by households and businesses (user pays); household and business obligated to participate; and the municipality obligated to receive all waste supplied for disposal*" (Hafkamp 2002:12). The 'new' regime involved a shift of conventional principles in the waste management regime. The conventional principles at the heart of this regime include: the *prevention principle*, *precautionary principle*, *polluter pays principle (extended producer responsibility)*, *free trade principle*, *principle of subsidiarity*, *proximity principle*, and the *valorisation principle* (operationalised as the waste hierarchy) (Buclet et al. 2002), see Figure 1. Whilst these principles are common at the European level, it is their institutional articulation into political objectives which leads to the variation of technological trajectories of national waste management regimes.

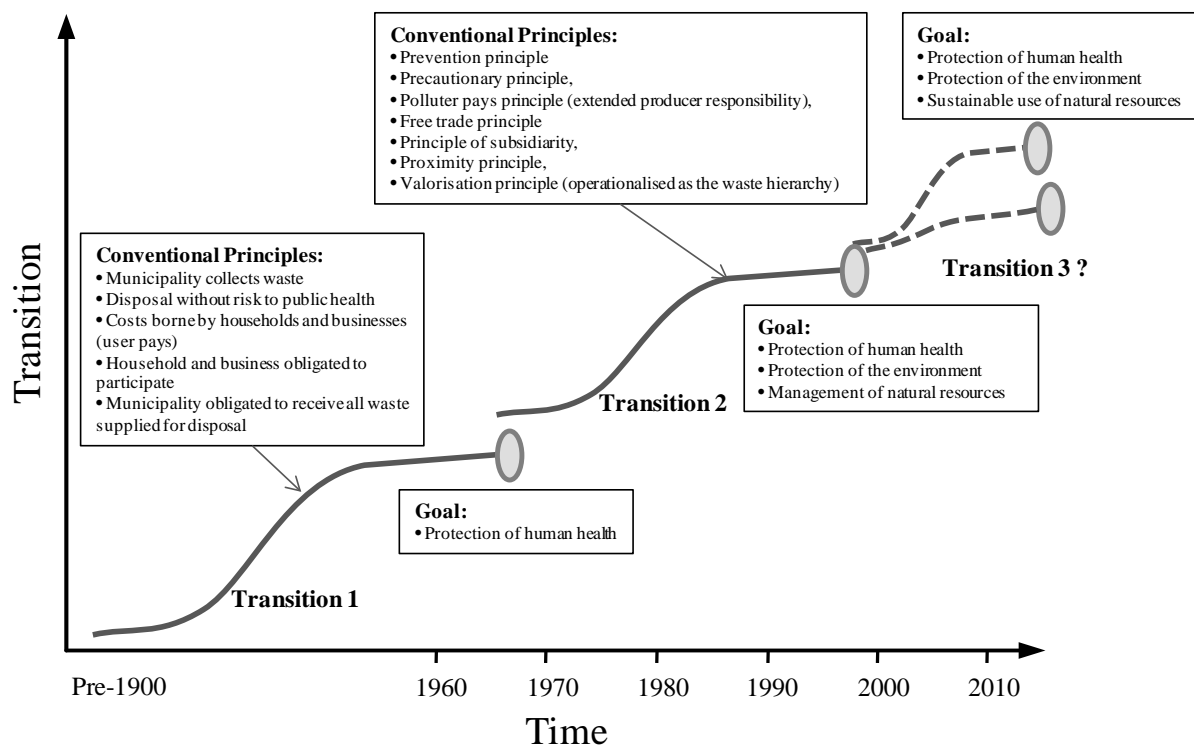


Figure 1. European Waste Management Transitions (Adapted from Parto et al. (2007))

4. Life cycle thinking and the waste hierarchy - The current approach

At a strategic level, the life cycle approach is commonly operationalised through LCA and applied in a definitive role to provide an authoritative justification for decision making (Heiskanen 1999). LCA is predominantly applied to waste management in a comparative capacity, whether it be the comparison of waste treatment technologies, the comparison of competing waste management strategies (including a new strategy verse the status quo) or the comparison of policy instruments (e.g., incineration taxes).

A prominent example of this comparative application is the Waste Framework Directive (WFD) where LCT is applied in relation to the waste hierarchy:

“The following waste hierarchy shall apply as a priority order in waste prevention and management legislation and policy: (a) prevention; (b) preparing for re-use; (c) recycling; (d) other recovery, e.g. energy recovery; and (e) disposal.

This may require specific waste streams departing from the hierarchy where this is justified by life-cycle thinking on the overall impacts of the generation and management of such waste.” (Emphasis added) (Council Directive 2008).

In this case, life cycle knowledge based on information from LCAs, both from individual studies or collective knowledge built upon numerous previous studies, may be used as a test for the departure of waste streams from the waste hierarchy. Figure 2 illustrates the current use of LCT in the WFD - an approach used to deviate from the waste hierarchy when life cycle based assessment shows the waste hierarchy not to be valid.

4.1. LCT based analysis as a test for the waste hierarchy

In this application of LCA, we can see the principle of the waste hierarchy being challenged - testing its legitimacy as a principle of waste management. This test will result in either: (1) the confirmation of the waste hierarchy, (2) the modification of the interpretation of this principle or the evolution/refinement of the principle itself (for instance, the development of waste hierarchies tailored to specific waste streams, and/or a more detailed hierarchy of technological options), or (3) the rejection of the waste hierarchy and its replacement by another principle. Today, we can see this test of legitimacy taking place. LCA studies are testing the waste hierarchy as to its legitimacy for various waste streams and the interpretation of the waste hierarchy is debated at the policy level (both Member State and EU).

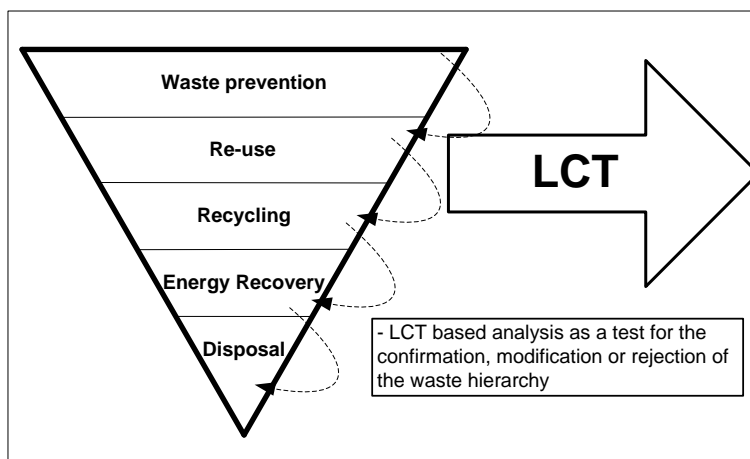


Figure 2. Current application of LCT in the context of the Waste Framework Directive

In the context of transition management toward a 'recycling society', the use of LCT as a justification for the departure of material streams from the waste hierarchy seems somewhat limiting. A primary benefit of the life cycle approach lies in the identification material and energy flows and salient areas of environmental impact. Additionally, consequential analysis attempts to identify the environmental consequences of decisions in both primary systems (such as the waste management system) and secondary systems (such as energy and material production). However, relying on LCA to settle public controversies¹ can be limited as they often become focused on the technical arguments² surrounding certain claims - masking the normative positions in such controversies (Sarewitz 2004).

Additionally, the WFD states "*Member States shall take into account the general environmental protection principles of precaution and sustainability, technical feasibility and economic viability, protection of resources as well as the overall environmental, human health, economic and social impacts...*" (Council Directive 2008). Despite the importance of these issues, using LCT to deviate from the waste hierarchy (in the long-term) may risk the establishment of waste infrastructure with significant sunk costs. This in turn would heighten the potential for technological, behavioural and institutional lock-in of a system that is not congruent with the principles supporting the long-term goal of sustainable waste management.

¹Such as the choice between recycling and incineration with energy recovery, or the resistance to incineration with energy recovery as an alternative to landfill

²Selection of allocation procedures, definition of system boundaries, definition of functional unit, etc.

5. Toward a conceptual framework for life cycle thinking in waste management transitions

5.1. Transition framework

Kemp and Loorback (2003) note the management of transitions requires a two pronged strategy of: (1) system innovation: a new trajectory of development or transformation through a fundamental change in functional systems and product chains and (2) 'system improvement': the improvement of an existing trajectory. This involves not only technical change but also institutional change. In terms of transitions toward sustainable waste management, we propose expanding the use of the life cycle approach to both: (1) coordinate system innovations (which are based on conventional principles and objects in line with the vision of a 'recycling society') that fundamentally change the function of waste management - from the primary function of the treatment of waste to the primary function of producing secondary raw materials (SRMs), and (2) foster system improvement of existing technical systems, where the application of LCA is more akin to eco-design - identifying 'hot spots' of environmental impact that would require change in order for recycling to be the preferred technological trajectory.

The key components of this framework borrow from transition management; the establishment of a long-term goal, guiding vision, transition paths and interim goals.

5.1.1. Long-term goal

At the European level a long-term societal goal for resource and waste management has been explicitly established in the Thematic Strategies on *The prevention and recycling of waste* (European Commission 2005a) and *The sustainable use of natural resources* (European Commission 2005b). The EC sets a long term goal of the '*sustainable use of natural resource*' by means of reducing the environmental impacts generated by the use of natural resources, preventing waste generation and promoting recycling and recovery of waste which can in turn increase the resource efficiency of the economy. Looking at previous waste management transitions in Europe (See Parto et al. (2007)) we can see an evolution in the long-term goals guiding the development of waste management systems - from the protection of human health¹, to the protection of human health and the environment², to the current sustainable use of resources.

5.1.2. Guiding vision

A guiding vision is a system image with technological and behavioural components that are appealing and imaginative (Kemp and Loorbach 2003). The EC has established, a long term vision for a 'recycling society' that "*seeks to avoid waste and uses waste as a resource*" (European Commission 2005, 6). In

¹ In the transition from unregulated handling to centralised systems of disposal – between the mid 19th century to the 1960s

² In the transition from waste disposal to waste management - between the 1960s and 2000

effect, this image establishes a vision of the circular flow of materials within society. Visions guiding sustainability transitions are always under review, but nonetheless drive the transition management process. Refining the ‘recycling society’ has included visions of varying aspirations: from “*A society where the overall levels of waste generation are low and trending downwards*” to “*A society should be based on the principles of efficient use of resources, of prevention and reuse as well as the efficient use of waste once generated*” to a society where “*the emphasis is the delivery of quality recycling rather than recycling as an end point, the goal is environmental protection and the better use of resources*” (IEEP et al. 2010, 101).

In fact, there may be alternative visions which influence waste management, such as the vision of a low carbon society. These alternative visions are not mutually exclusive and known collectively as a ‘basket of images’. Alternative visions can be used to coordinate action in the formation of alternative transition paths, producing a competitive selection environment for innovation.

5.1.3. Transition paths

The transition toward this long-term goal can be achieved through a number of transition paths. Transition paths are possible routes to achieving these normative images. Transition paths incorporate interim objectives to achieve these images of the future through the improvement of current systems and system innovation (Kemp and Loorback 2003). Multiple transition paths are essential in the transition process. The *portfolio management* of different configurations (both incremental and radical) of system innovations is necessary to: (1) circumvent lock-in of a sub-optimal ‘one horse’ strategy, and (2) to provide a competitive selection environment where these niche innovations compete for space in the incumbent socio-technical regime. Kemp and Loorback (2003) identify Industrial Ecology (IE) as an example of system innovation¹. The following section will focus on IE as one potential transition path. Figure 3 illustrates the conceptual framework described in the preceding section.

¹Other examples may include, Product Service System, Cultivating Communities, Local Exchange Trading Systems

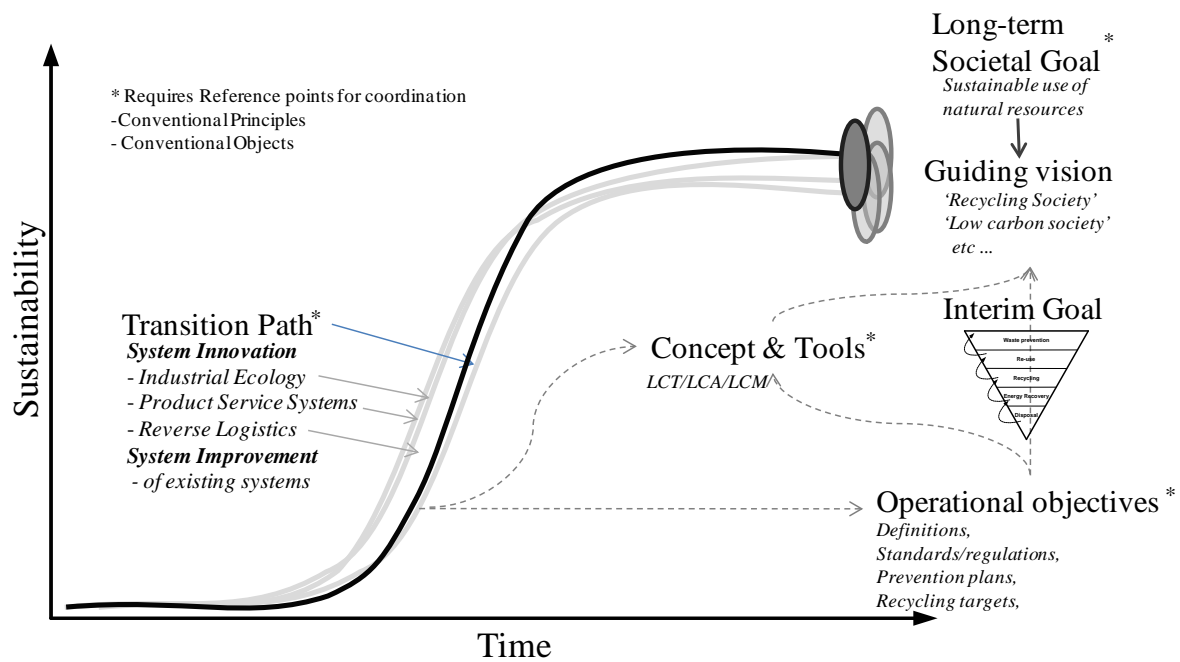


Figure 3. A life cycle approach to system innovation in waste management (adapted from Kemp and Loorbach 2003)

5.1.4. Interim goals

Interim goals are an important part of transition paths. These interim goals are a product of the policy regime. Legally sanctioned regulative instruments explicitly establish the 'rules of the game', a game played by actors, firms, suppliers, users, public authorities and scientists. Regulative rules (such as laws, definitions, waste management plans, quantitative targets, standards and financing structures) are a product of the interpretation and institutional articulation of the waste management principles guiding and providing stability in the regime.

IE is loosely based on the metaphor of ecosystems, where industrial systems are viewed in terms of material and energy flows. IE exemplifies the need to close energy and material loops, dematerialisation and thermodynamically efficient energy utilization (Ehrenfeld and Gertler 1997). The waste hierarchy has ontological similarity with IE - closing material and energy loops. Hence, making the waste hierarchy an interesting principle in waste management regimes as it provides a reference point for coordination of action toward achieving a 'recycling society'. IE's analytical tools include *inter alia*, LCA and material flow analysis which aid in the design of ideal-typical closed loop systems (Ehrenfeld and Gertler 1997).

Does the waste hierarchy equate to sustainable waste management? No. However, the waste hierarchy is more than just a decision making framework. The principle of the waste hierarchy¹ guides individual and collective action. The mantra of 'reduce, reuse, recycle' is well known outside the waste management sphere, guiding the waste disposal actions of individuals and collectives. In terms of waste

¹The operational version of the valorisation principle and broader sustainability principles (including the prevention principle)

management strategies, it has been a policy aspiration of many regimes (be they local or national) to move waste management activities up the steps of the waste hierarchy. Indeed, moving up the steps of the waste hierarchy can be seen as an interim goal in the transition to sustainable waste management. Although this is an interim goal, it is important to recognise this principle is subject to challenges (as described above), especially by those actors who may not agree with the principle. In this sense, we may see the waste hierarchy as a principle that guides several operational objectives of waste management regimes, such as definitions, recycling and recovery targets, and waste management plans

In terms of sustainability transitions, Figure 4 conceptually represents an alternative use of LCT. In addition to the current use of LCT in testing the legitimacy of the waste hierarchy, LCA is applied to aid in the design of niche SRM supply chains (material recycling) that are favourable from an environmental perspective when compared to energy recovery or disposal. Additionally, LCM is used to coordinate action among actors in the innovation of niche technologies and SRM supply chains which establish a technological trajectory toward a 'recycling society'.

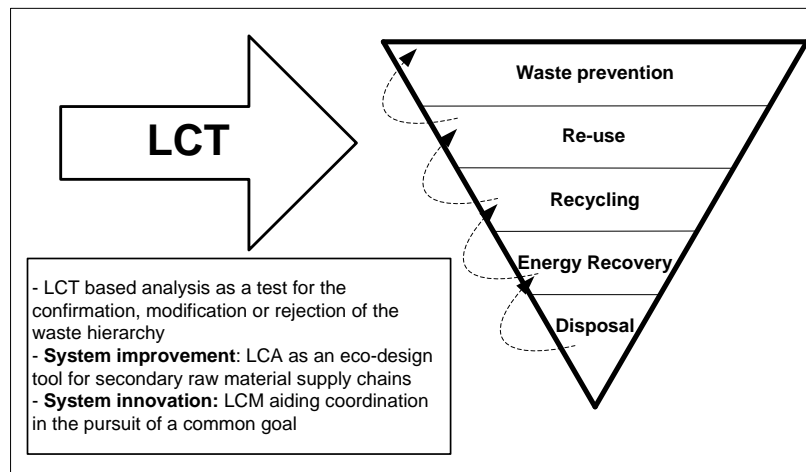


Figure 4. The use of LCT from a transition perspective

5.2. Applying the life cycle approach in waste management transitions

5.2.1. System improvement: LCA as an eco-design tool for niche secondary raw material supply chains

Moving away from the comparative application of LCA, thereby using LCA to identify 'hot spots' of environmental impact in niche SRM supply chains, may allow for the identification of changes required to make recycling the environmentally preferable technological trajectory. The benefit of LCA is its ability to identify the consequences of decisions. LCA may be used to identify system requirements necessary for prevention, re-use or recycling to become the preferred technological trajectory. One example is the virgin material substitution ratio that is required for material recycling to obtain a favourable environmental performance when compared to energy recovery. Additionally, if one was to relocate waste material from energy recovery to material recycling processes, an LCA could inform the choice of the waste stream that would be used to fill incinerator capacity, whilst maintaining recycling as

the preferred technological trajectory. However, whilst the LCA may be useful in stimulating system improvement, the 25-50 year temporal frames of transitions may limit the use of quantitative modelling of system improvement due to the radical uncertainty associated with such time frames. Additionally, as the life cycle approach focuses on the 'improvement' of product and system services, there also lies the risk of optimising the efficiency of an ineffective system.

Notwithstanding these limitations, this approach raises the question of responsibility. Who takes the lead role in such an eco-design process? The challenge in this case is that unlike product design, where the designer has greater responsibility and control for product design, processes in waste management systems are spread throughout the supply chain. One place to start may be the entity which has responsibility of the waste; depending on national conventions this may be the local municipality or a private entity who takes over ownership of the waste when providing waste management services for public authorities. Although these actors may start the transition, due to the diffuse nature of SRM supply chains, principles and conventional reference points (congruent with the principles of the '*sustainable use of natural resources*') are required in order to coordinate such action. In this instance, LCM may be an interesting strategy to pursue.

5.2.2. System innovation: LCM aiding coordination in the pursuit of a common goal

Although IE offers an analytical framework and future vision, it is less concerned with the process and organisation of change required to reach this future vision. Likewise, LCA is concerned with identifying the potential environmental impacts of system improvement, but not the establishment of such change. Heiskanen (2000b, 32) identifies several logics of the life cycle approach, such as "*the responsibility for the environmental burden of a system accrues through participation in the flow of materials and energy in its physical life cycle*". Combining life cycle logics and the principles of IE, closing material and energy loops may be one option to coordinate action in the establishment of a technological trajectory toward sustainable waste management. The LCM strategy is based on the concept of LCT and hence the logics and principles of LCT. LCM can aid the coordination of action as certain actors in the product supply chain recognise that the responsibility for the environmental burden of a product system is the collective responsibility of all actors in the product system. An example of coordination through LCM is the GHG¹ Protocol Initiative. The GHG Protocol Initiative for corporate accounting and reporting of GHG emissions will soon require the inclusion of indirect emissions which occur along the product chain (Scope 3 emissions accounted utilising a life cycle approach). In certain cases these Scope 3 emissions may be considerably greater than direct emissions (Scope 1) and indirect energy use related emissions (Scope 2). Scope 3 accounting has the potential to develop new actor-networks linked by material and energy flows. Thus the goal to reduce GHG emissions requires both the reduction of Scope 1 & 2 emissions and the collaboration with upstream and downstream actors to reduce Scope 3 emissions.

¹ Greenhouse Gas

5.2.3. Subsidiarity: Level of implementation

As the WDF came into effect on 12 December 2010, how Member States will apply the waste hierarchy is still to be determined. However, in addition to the waste hierarchy having achieved the status of a 'priority order'¹, a number of articles emphasise its importance as a guiding waste management principle. Namely, Articles 28(1) and 29(1) require both waste management plans and waste prevention programmes, respectively, to be established in accordance with the waste hierarchy. Additionally, the principle of subsidiarity is also a concern when applying the waste hierarchy. Applying the waste hierarchy through waste management plans, coupled with European case law², would require the waste hierarchy to be applied at the administrative level in which the waste management plans apply.

Although the goal of many Member State waste management strategies has been to place emphasis on the waste management activities closer to the top of the waste hierarchy³, there has been a very broad interpretation and implementation of the waste hierarchy in various member states (Lazarevic et al. 2010). The new legal status of applying the waste hierarchy as a priority order may, indeed, influence the landscape of European waste management, especially considering that the hierarchy should be implemented (or LCT used to show justification for the departure of waste streams) at the administrative level. This may have an influence on planning decisions for competent authorities. It is at this level in which industrial and territorial ecology transition path experiments should be facilitated.

6. Discussion and Conclusion

This framework highlights the use of LCT in three main areas: (1) as a test for the legitimacy of the waste hierarchy principle management, (2) as an eco-design tool for the production of niche SRM supply chains, and (3) as an element which aids in the coordination of actors in the development of niche innovations along a technological trajectory which ascends the levels of the waste hierarchy.

Reflecting on transition management, LCT appears to be a potential 'transition element' in the transition to sustainable waste management, "*elements at each of the three levels (regime, niche, landscape)*⁴ that could link up to create novelties as a potential prelude to a transition" (Elzen et al. 2002, 16-17). These transition elements not only concern technologies, but can include concepts and new forms of embedding technologies and concepts in society. The LCT concept acts as a transition element in the sense that: (1) using LCA as an analytical tool in the eco-design of niche SRM supply chains helps in the establishment of a number of niche innovations where recycling is the preferred technological trajectory, and (2) using LCM to aid the coordination of actors may assist in moving technologies, technology selection environments or niche products (such as new SRMs or new applications of SRMs) from the niche to the regime (main-stream) level.

¹ See Lazarevic et al. (2010) for detail on the evolution of the salience of the waste hierarchy in European waste policy

² Such as Inter-Environnement Wallonie ASBL v Région wallonne (1997) - Case C-129/96

³ For example, the England and Wales 1995 waste strategy 'Making Waste Work' (Department of the Environment 1995) places the waste hierarchy as a key objective, yet relatively slow progress has been made in achieving this goal during the past 15 years.

⁴ The three levels of the multi-level perspective. A niche based model developed as a framework for understanding sustainability transitions which provides an overall view of the dynamics of change in socio-technical systems.

A number of models of transition paths exist to help understand how innovations move from the niche to the regime (Geels and Schot 2007). Using the life cycle approach as a transition element may assist system innovations moving from the niche to the regime if the principles guiding the development of niche actives are congruent with the conventional principles of the regime. Systems innovations such as those informed by the concept of IE, closing material and energy loops, are in keeping with the dominant conventional principles of waste management (*the precautionary principle, the prevention principle, the valorisation principle*). Hence, development and activation of a transition agenda (the long-term goals, transition paths, interim goals and operational objectives) which utilises LCT as a transition element may help facilitate the transition toward sustainable waste management.

This paper has made a first attempt at developing a conceptual framework for transitions in waste management regimes by combining the theoretical concepts of transition management and conventional regimes. By extending transition management to include the concepts of conventional regimes and life cycle thinking we may be able to: (1) provide a greater understanding of the role of the waste hierarchy and life cycle thinking in transitions toward sustainable waste management, and (2) utilise the life cycle concept in both system improvement and in the coordination of actors in the development of system innovations which embody the principles of closing material and energy loops. This use of the life cycle approach raises a number of lines of enquiry that will be the focus of further research. More specifically: (1) the salience of conventional principles of waste management regimes, at national and administrative levels, and (2) the characteristics of LCT/LCA that allow it to be used as an effective tool in waste management transitions.

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LAND USE FOR BIOENERGY PRODUCTION – ASSESSING THE PRODUCTION POTENTIALS AND THE ASSUMPTIONS OF EU BIOENERGY POLICY

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ABSTRACT – *Global land use is becoming increasingly competitive because of population growth, economic growth and climate change mitigation actions. More agricultural land is required to produce food for the growing populations, and at the same time vast tracts of land are reserved for bioenergy production to fight climate change. Land is becoming a scarce resource and integrated land use planning becomes increasingly important. However, the current EU bioenergy policy sets a high goal which is based on three key assumptions: by replacing fossil fuels with biofuels it's possible to gain remarkable reductions in GHG emissions, increase energy security in the EU and spur rural development both in the EU and in developing countries. Possible negative impacts of such a policy are almost completely neglected. In this paper, bioenergy potentials estimations are reviewed, and the critique to the EU bioenergy policy is presented; moreover, impacts on rural development and developing countries are pointed out.*

1. Introduction

Climate change, global population growth and a rising energy demand are interlinked processes with conflicting dimensions. More agricultural land is needed to feed the increasing global population and simultaneously economic growth increases the energy consumption of societies. At the same time, diminishing reserves of fossil fuel, requirements set forth from the climate change mitigation point of view, and on-going debate on the use of nuclear power indicates a need for increasing amount of renewable energy. Bioenergy is often addressed as one of the main factors in the portfolio of solutions proposed to fight climate change (McKendry, 2002).

Bioenergy can be derived from various biomasses such as wood, grains, oil seeds, sugar cane, grasses and straw, human and animal manure, agricultural residues and food waste from food industry and households. Traditionally bioenergy has been exploited by burning wood or cow dung, and modern bioenergy production includes processing biomasses into liquid and gaseous fuels such as bioethanol, biodiesel or biogas. The liquid transportation fuels produced from biomass are usually called biofuels, in distinction from other types of bioenergy. In this paper we focus on bioenergy produced from cultivated

biomasses, which means usually biofuels for transportation. We look at the issue from the perspective of land use and interaction with the food production systems.

Bioenergy production from cultivated biomasses has a strong land use dimension in it because it requires a lot of land per energy unit produced. Cultivating energy is not only about substituting one energy source with another; it is also substituting one land use pattern with another. Allocating vast tracts of land for bioenergy production is a political decision and currently the EU and USA are heavily promoting and subsidizing bioenergy production for various reasons. Bioenergy is presented as a renewable and sustainable form of energy, which increases the energy security and improves rural development in developed and developing countries. Bioenergy is considered to possess huge production potentials globally and it is seen as a promising substitute of the polluting fossil fuels.

In this paper we first review the estimations that have been carried out by various authors for the calculation of bioenergy potentials. Different ways of calculating the potential produce a wide range of results for the possible amount of bioenergy available. After looking at the calculation procedures and assumptions of the potentials, we summarise the bioenergy policy of the European Union and the assumptions it is based on. Next, we review the critical discussion that has been going on about the validity of the EU bioenergy policy assumptions and the impacts of biofuel production on the environment and people. In the conclusions we point out the links between the EU bioenergy policy and the estimations of bioenergy potential, and observe the impacts of bioenergy production on the environment and people.

2. Bioenergy potential estimations - assumptions and methods

Estimations of bioenergy potentials have been calculated with different assumptions and for different time-frames, though most studies have been carried out until either 2050 or 2100.

The first two distinctions that need to be made concerning the different estimations are a) between *demand-driven* and *resource-focused* assessments and b) between *theoretical*, *technical*, *economic* and *implementation potential*.

A *demand-driven* assessment is one that analyses the competitiveness of biomass based electricity and biofuels, or estimates the amount of biomass required to meet exogenous targets on climate neutral energy supply, while a *resource-focused* assessment focuses on the total bioenergy resource base and the competition between different uses of the resources (Berndes et al., 2003).

An estimation of biomass potential can be then classified as:

- **Theoretical:** describes the theoretically usable physical energy supply in a given region in a certain time span. It is solely defined by physical limits and thus represents the upper limit of the energy supply contribution theoretically feasible. For the evaluation of the real availability of biomass the theoretical potential is thus of no practical relevance.
- **Technical:** part of the theoretical potential that can be used given current technical possibilities. Takes into account structural, ecological (e.g. nature conservation areas) and other non-technical restrictions. Describes the possible contribution of renewable energy to the satisfaction of the energy demand from a technical perspective, depending on time and location. Less subject to fluctuations than the economic potential.

- **Economic:** part of the technical potential that is economically exploitable in the context of given current basic conditions.
- **Implementation potential:** refers to the expected actual contribution, usually lower than the economic potential. Heavily affected by policy and can even be greater than the economic potential, if for example the option for using renewable energy is subsidised (e.g. market introduction programme).

The ideal study would estimate the technical potential through an intersection of a supply curve (supply as a function of price) with a demand curve (demand as a function of price), but the reality is that most studies focus on either side and some do not specify clearly to which type of potential they are referred to (Thrän et al., 2010).

The estimations of bioenergy potentials and land availability for bioenergy production imply a set of assumptions related to their main drivers. These are, among others, the development of the global population, the impacts of climate change, growth rates of per-capita consumption of food and developments in agricultural yields.

From a review of calculations in this field, two relevant issues can be pointed out: in the first place that there is a huge variety in the results, and in the second place that the contribution of bioenergy produced developing countries is much more relevant than that of industrialized regions.

As explained above, the variations in results are due to the difference in assumptions and calculation procedures, as well as in the classification of certain bioenergy sources: this is the case of forest residues, which in some studies are restricted to the residues resulting from thinning and logging, industrial production processes, and waste, while in others include also the annual forest increment. This leads to estimations of potential of this fraction of bioenergy which range from zero to 150 EJ/yr in 2050 (Thrän et al., 2010). If potentials of other residues are more stable according to the different studies (i.e. estimations of potentials of crop residues in 2050 range from about 20 to 70 EJ/yr), in the case of energy crops the potentials calculated are between 0 and 1272 EJ/yr (Thrän et al., 2010). This is due mainly to two factors: estimation of actual availability of plantation areas and estimation of actual yield levels of new generation crops. This is particularly evident in the study by Lashof et al. (1990), in which even the lowest assumptions of global average yield are significantly higher than in the other studies, and even higher than the indicated maximum woody biomass yield level (Berndes et al., 2003). These uncertainties are reflected in the results.

3. EU bioenergy policy - and its critique

Currently the European Union is a major promoter of bioenergy. By 2020, 20% of the total energy used in the EU and 10% of the transport fuel in each member state must come from renewable sources. In the background of the ambitious bioenergy policy are three important factors: peak oil, climate change and the dependency of the European economy on the vast and ever growing transport sector, which currently runs on fossil fuels. The EU biofuel policy is being justified by three key assumptions: by replacing fossil fuels with biofuels it's possible to gain remarkable reductions in GHG emissions, increase energy security in the EU and spur rural development both in the EU and in developing countries.

The EU transport sector accounts for more than 30% of the total energy consumption in the Community. According to the EC Biofuels Research Advisory Council, the growing transport sector is one of the main reasons for the EU failing to meet the Kyoto targets. It is expected that 90% of the increase of CO₂ emissions between 1990 and 2010 is caused by the transport sector (Biofrac, 2006).

Increasing energy security is one of the key goals of EU renewable energy policy. The European economy is heavily dependent on the growing transport sector, which runs on fossil fuels imported from politically unstable areas. The EU aims at increasing its domestic energy production and is thus promoting biofuel production in its area.

The development of bioenergy production is supposed to diversify the production base and create new employment opportunities in the rural areas of both industrialised and developing countries. EU biofuels policy assumes that the impacts of biofuel production and consumption will be “largely beneficial”, and if any harms occur, they can be managed by self-regulation or mitigated e.g. by technological innovations (Franco et al, 2010). One important question to ask is: beneficial to whom?

3.1. Critique of the pro-biofuel development

The benefits of biofuels have been criticised by numerous scientific studies and environmental, human rights and food sovereignty organisations. The critics say that biofuels are not reducing CO₂ emissions when all factors in the life cycle are counted in, they cause land use competition and threaten food security and biodiversity.

3.1.1. Impacts on food security

One of the main arguments of the critics of biofuel production is the resource competition between bioenergy and food production and the possibly detrimental impacts on food security. Cultivating crops for energy production competes with food production in several ways. Food crops such as corn, soy, grains, rapeseed, and oil palm fruits are directly used as raw material for biofuels. Majority of the bioenergy that is currently produced from cultivated biomasses is first generation biofuels, which compete directly with food production by using edible plants as raw material and by requiring vast areas of agricultural land. Energy crops also compete with food production for clean water and phosphorus, both of which are finite resources, and for fossil energy for running the agricultural machinery.

The so-called second generation biofuels have been presented as a solution to this “food versus fuel”-dilemma, because they are produced from non-edible energy crops, such as jathropa and switch grass. However, agricultural land is needed also for the cultivation of these crops, which reduces the amount of land available for food production or forces farmers to clear new land for agricultural purposes, thus causing indirect land use change.

The cultivated second generation bioenergy plants, such as jathropa and reed canary grass, do not require as high quality soil as food crops and they can be grown on land that is not suitable for food crop cultivation. This is related to one of the key concepts used when the beneficial effects of biofuels to rural development are described, “marginal or degraded land”. It is assumed that there is plenty of available land that is not currently used by anybody. However, defining a given piece of land as marginal includes great risks of ignoring the multiple ways how local populations may be using the area e.g. for collecting food and fuel. The so called marginal lands are often pasture lands and thereby an integral part of the

local food production system. Conceptualising land as marginal or degraded makes it look like a beneficial development to transform it into agroindustrial production of biofuel feed stocks, such as jathropa (Franco et al., 2010).

3.1.2. Increasing CO₂ emissions from land use change

The conception of biofuels as an efficient way of decreasing CO₂ emission is based on the idea that biomass is carbon neutral; when it is burned, it only releases the carbon that was sequestered in the plant when it was growing. However, the picture changes radically when all the energy consumption and carbon emissions from the whole life cycle of the biofuel are counted in. Production, harvesting and processing of the biomass and transporting the end product to consumers are all processes that use a lot of fossil energy and emit CO₂.

Most importantly, the direct and indirect land use changes occurring from biofuel production are turning the emission reductions to minimal or even negative. Several research results have shown that the carbon debt caused by direct land use change is so big, that it takes from 20 to 420 years for the biofuel to reduce carbon emission by as much as was released in its production process, depending on the feedstock and the production techniques. Indirect land use change is not included in these figures, and it increases the payback time e.g. for US corn ethanol from 93 to 167 years (Fargione et al, 2008). Biofuels from switch grass, if grown on US corn lands, increase emissions by 50% (Searchinger et al, 2008).

Even if biofuels are produced in optimal conditions and CO₂ emission reductions are achieved, biofuels are a very expensive way to reduce CO₂ emissions. The Global Subsidies Initiative of the International Institute for Sustainable Development calculated the price of decreasing CO₂ emissions with biofuel. They used life cycle analyses which did not include emissions from land-use change or the use nitrogen-based fertilizers, and resulted in the cost of abating a tonne of CO₂-equivalent through biofuels to be extremely high due to the level of support they require in the form of subsidies. In the EU the cost ranged from €575–800 for sugar-beet ethanol, and over €600 for rapeseed biodiesel (Steenblik, 2007). Improving the fuel efficiency of cars could result in equally large CO₂ savings with a fraction of the costs and even creating profit from the fuel costs saved (Oxfam, 2008).

3.1.3. Energy security

The argument of increasing energy security in the EU with biofuels is questionable for at least two reasons. First, even if 10% of the transport fuel would come from biofuels by 2020, that still leaves 90% of the transport energy to be acquired from fossil fuels. Second, there is not enough arable land in the EU to produce all the needed feed stocks, so majority of them have to be imported. For example Germany, which has been the leading producer and consumer of biofuels in Europe already from the 1970's, imported 60% of its biomass used for energy already in 2006 (Franco et al, 2010.)

Already in 2008 the European Environmental Agency's Scientific Committee warned that the 10% biofuel target is overambitious. The EEA estimated the amount of available arable land for bioenergy production without harming the environment in the EU (EEA, 2006) and concluded that the land required to meet the 10 % target exceeds this available land area even if a considerable contribution of second generation fuels is assumed. According to the EEA, the 10 % target will require large amounts of

additional imports of biofuels, but the ecologically sustainable production outside Europe is difficult to achieve and to monitor (EEA, 2008).

Another argument for criticising the assumption of increased energy security is the dependency of biofuel production on fossil fuels. Biofuels are presented as a substitute for fossil fuels, but their production is totally dependent on fossil fuels. Fossil fuels are needed to work the land, sow the seeds, and produce synthetic fertilizers and pesticides, to harvest the crops and to process and transport the end product. In order to genuinely decrease dependency on fossil fuels, the production processes of biofuels would have to run completely on renewable energy. That would consume a great share of the biofuels produced, and make the achievements of the biofuel targets even more difficult.

3.1.4. Effects on the rural development in developing countries

Majority of the expansion in bioenergy crop cultivation currently happens in the biologically rich and productive areas in developing countries, and the new land for food production is often cleared from forests and grass lands.

Some studies have carried out estimations for different regions of the world. In Figure 1 is a summary of the results of these studies for the year 2050, with a distinction between developing and industrialized countries. The global primary energy supply in 2007 (IEA, 2009) is reported for reference.

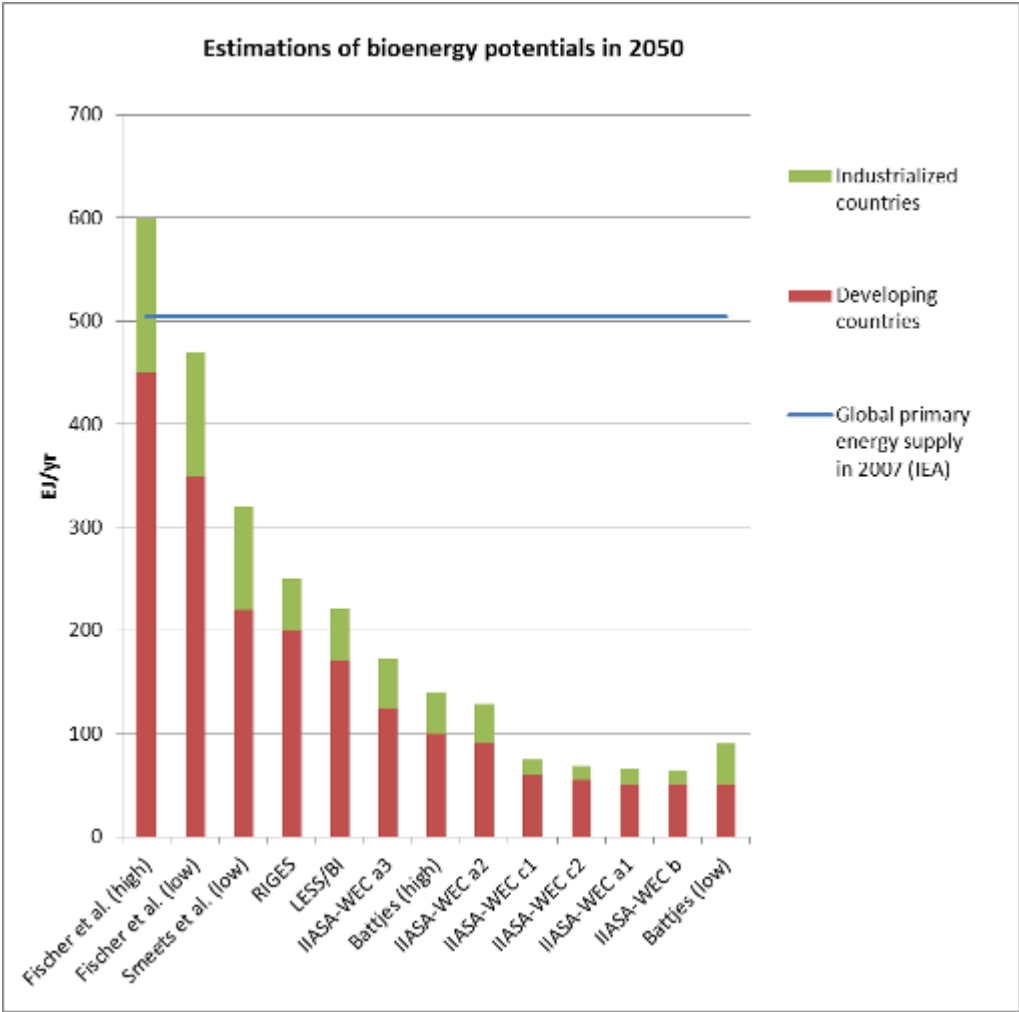


Figure 6. Contribution of industrialized and developing regions to total bioenergy supply in 2050. Estimations are taken from Berndes et al. (2003) and Thrän et al. (2010)

As can be seen from the graph above, in most of the studies, the share of the contribution of the developing countries is much higher than that of the industrialized ones, though the amounts reported here do not necessarily correspond to the demand in the corresponding regions for the demand-driven studies. For examples, in the study by Johansson et al. (1993), Africa produces about 22 EJ/yr methanol (produced from 34 EJ/yr of biomass) in 2050, but only one third of this methanol is consumed in the same region, the rest is exported. Also in the case of resource-focused studies it results that substantial volumes of biomass can be made available for energy in developing countries, but, since the bioenergy demand in these regions is expected to be growing slowly, significant exports of biofuels to industrialized countries may be necessary for the realization of this potential (Berndes et al., 2003)

According to Oxfam international, so far the effects of agroindustrial biofuel production in the rural areas of developing countries have been mostly negative. Agricultural land has been acquired by the big agrofuels companies by illegal methods, severe ecological consequences have occurred on the soil and water, the employment opportunities for the local population have been few and often with bad conditions (Oxfam, 2008).

According to White and Dasgupta (2010), agroindustrial biofuel production is a new form of colonial expansion to the rural areas of developing countries and may open doors also to GM biofuel crops. For the local producers in developing countries the specific destination of their produce as food, fuel or some other end use in a faraway place is probably of less interest than the forms of direct or indirect appropriation of their land and the forms of their insertion or exclusion as producers in the global commodity chains (White and Dasgupta, 2010).

4. Discussion and Conclusions

The land use choices between food and energy production have different consequences at different spatial levels. On a sub-regional (e.g. on the level of a province) and on a national level a shift towards the use of land for energy production can make sense, as long as trade assures on the one hand a sufficient market for the energy produced and offers on the other hand enough food products for the respective region on an adequate price level. On the level of regional integration (e.g. European Union) a division of labour between sub-regions and Member States may also be rational: some producing food, others energy. The picture changes essentially when the trade on food and energy products moves to the global level. In the industrialised countries, especially in the densely populated countries of Europe, the population is requiring a land area much bigger than its own country to satisfy demand for agricultural products. Thus land resources of other countries are used to produce food and increasingly also energy. In other words, the European impact on agricultural land is being displaced to developing countries (Bringezu et al., 2009) This increased demand for land to cover consumers' demand on the other side of the globe threatens food security in the regions which are not self-sufficient in food production. In developing countries like most areas of Africa and some regions of Asia, a shift away from food production towards energy production might be disastrous considering the inappropriate nutrition of the population. On the global level a shift of the use of the land from local and regional food production towards the production of energy for the global market (mainly the needs of the industrialized north) results in increasing food prices and a lack of food in developing countries.

Agricultural land is becoming a scarce resource and decisions made on energy policy e.g. in the EU have consequences on the global land use. At the moment the rapid increase in biomass cultivation for biofuels is driven by volume targets rather than by land use planning (Bringezu et al., 2009). This is reflected also in some demand-driven scenarios and estimations, which make assumptions that do not take into account the actual land availability necessary to support very high yields of energy crops. Sustainable use and equitable sharing of natural resources are political questions. The values and power relations that affect global natural resource policies need to be debated widely in the society and the issue of sustainable land use goes far beyond the local or regional land use policies.

The problems related to the sustainability of the large scale production of biofuel feed stocks are widely known, and the EU is setting sustainability criteria for the biofuels that are imported to the EU. However, from the large body of research made on the actual sustainability of large scale biofuel production, one may conclude that the current trend of centralised agroindustrial biofuel production for the markets in the industrialised countries is not without serious drawbacks. It can be argued that the aggressive promotion of biofuels, carried out by the EU and the US, is a way of buying time. In the light of the research on the topic, substituting fossil fuels and curbing CO₂ emissions with biofuels is not possible without causing intolerable damage to the food security, ecosystems and human rights globally. The most important decisions on how to dramatically cut the fossil energy consumption in Western societies are not solved with bioenergy.

Appendix

Table 1. A summary of the studies included in Figure 1.

Study	Approach	Time-frame	Geographic aggregation	Resource focused	Demand driven
IIASA-WEC	Energy Economy model, six scenarios	1990-2100	11 regions		X
RIGES	Bottom-up energy supply construction.	1985-2050	11 regions	Xa	X
LESS/BI	Scenario extension of RIGES, using updated oil and gas resource estimates and including CO ₂ sequestration	1990-2100	11 regions	Xa	X
Battjes	Integrated land use/energy-economy model +expert judgement	2050	13 regions	X	
Fischer	Bottom-up calculation by using land use model of IIASA	1990-2050	11 regions	X	
Smeets	Bottom-up approach, based on an evaluation of data and studies on relevant factors	2050	11 regions	X	

^aThese studies have an upper limit of biomass energy availability for their demand driven scenario, based on a resource assessment (Berndes et al., 2003)

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5. SUSTAINABLE CULTURE

DRIVERS AND BARRIERS TO SUSTAINABLE DEVELOPMENT: A HISTORICAL-FUTURES PERSPECTIVE (CASE STUDY)

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ABSTRACT – *This paper argues that history can expand our sphere of practical reckoning and thus help us navigate climate change. Research undertaken as part of the Commonwealth funded South East Queensland Climate Adaptation Research Initiative (SEQCARI) profiled 33 historical case studies to identify common themes in the ways societies responded to stress. The case studies are intended to inform discussion with stakeholders in the four areas of human settlement and health; energy; agriculture, forestry and fisheries; and ecosystems and biodiversity. The case studies demonstrate that adaptive capacity varies with context and is affected by the complexity, scale, values, leadership and resources inherent to the social system examined. To increase the possibilities for reflection by stakeholders, the case studies were used to create a set of historical scenarios that explore some of the key features of human responses to challenges such as climate change. This paper draws on this work to suggest a set of practical lessons for those engaged with climate change today and into the future.*

Key words: *climate change, adaptive capacity*

1. Introduction

Ever since humans began organising into groups they have sought to guard against the vagaries of both the natural and social world. Natural disasters and human violence have deeply shaped the human psyche and lie at the heart of human social evolution. The tools (institutional, cultural, personal, technological) developed to respond to these challenges seek to ensure security and order in an environment that regularly upsets the most well laid plans. Humanity's technological, social and institutional inventiveness can therefore be understood as responses to this sense of vulnerability and disorder.

One way to understand human culture and social institutions is through the measures taken to increase security in the face of chaos. The social learning involved in this effort has been immense and is ongoing. Given the extensive historical record relating to this learning (the rise and fall of cities, societies, empires, civilisations), it is with a sense of déjà vu that we turn to the practical responses that

communities, cities, industries, and nations around the world might apply to address the threat of climate change. This is a question of sustainable development and how to achieve it and requires us to understand the drivers and barriers at work in such an enterprise. It is also important to acknowledge that this is not simply a threat to human security and human systems. Natural systems are just as vulnerable to climate change and ultimately just as central to considerations of human security. We are all in the one boat (Ponting 2007).

These reflections form the back drop to this paper which draws on historical research done as part of the South East Queensland Climate Adaptation Research Initiative (SEQCARI). The research has recently been finalised in the report *Societal Responses to Significant Change: an Historical Analysis of Adaptive Capacity* (Bussey et al., 2010). The goals of this research were: to profile key determinants shaping adaptive capacity within contexts; to profile the drivers and barriers to sustainable development in a region; and to suggest a set of historical scenarios for South East Queensland that would stimulate conversation with stakeholders in the four SEQCARI focus areas of Human Settlement and Health; Energy; Agriculture, Forestry and Fisheries; and Ecosystems and Biodiversity.

This paper opens with an explanation of how the research team constructed the social context in which practical responses occur. It then moves to explore four key determinants: complexity, technology, leadership and institutions. Case studies are presented that illustrate each determinant. They are followed by 'Practical Lessons' that allow for reflection on each. There is also a section on the historical scenarios developed for the report. These are treated in the same way as the case studies and used to generate 'Practical Lessons' for the future. The paper ends with a summary of these reflections and the suggestion that practical responses need to be understood as physical, social, cultural and personal responses to the issue of climate change.

2. Constructing the Social

The report profiled a number of civilisations at the point of their decline. The example we give in this paper is that of Angkor Wat (Case Study 3). From an historical perspective, cultures can be seen to carry the seeds of their own destruction: as Homer said of his beloved Greeks, Our excellence is our own fatal flaw. Thus, the question can be asked of our technologically gifted civilisation: Will our excellence be our own fatal flaw? Of course this is a premature, but sobering, question for us to consider. This is not a question about Luddites versus technophiles. It really is a question of social evolution at play through a range of discrete but also integrated socio-historical processes. These processes collectively constitute a dynamic cultural field, which is mapped, following Wilber's and Slaughter's work, as four quadrants (Wilber 2001; Slaughter 2004) that fold into one another across micro, meso and macro scales of action (Figure 1).

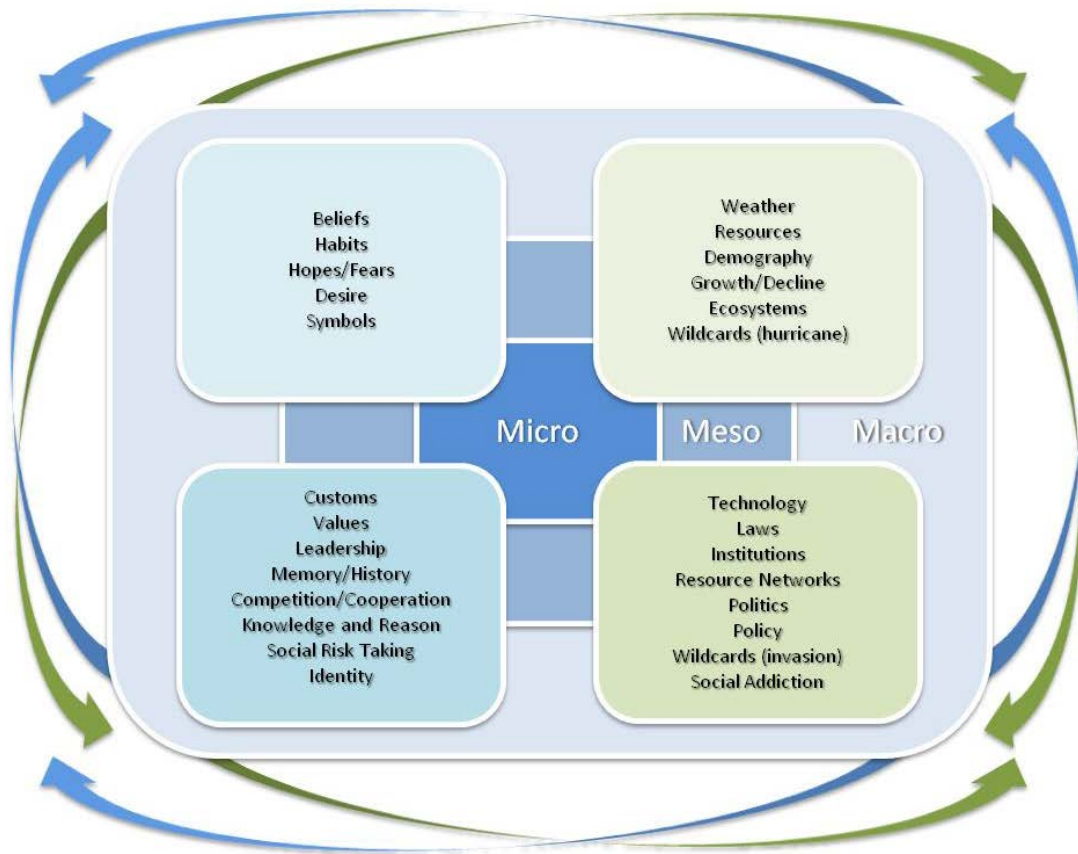


Figure 1. *Dynamic and Folding Field of Social Action*

This figure depicts physical events (upper right), social and institutional processes (lower right), cultural systems (lower left), and personal subjective states (upper left) as collectively constituting the reality in which all decision making, action and reaction takes place. In developing this figure, the research team was keen to illustrate that practical responses need to be considered through a socio-historical lens in which action is always framed by social, cultural and personal conditions (Inayatullah 2007; Diamond 2005). It was also important for these conditions to be understood as mutually reinforcing. For such a context to emerge, this paper argues that we need to understand the role that the key determinants of complexity of social process, technology, leaders and institutions have to play in social learning. Such determinants both drive the adaptive capacity that underpins sustainable development while also determining the barriers that do limit context.

These four key determinants are a subset of those identified by the report. In all there are nine key determinants affecting social learning and the degree of resilience present in any context. These determinants were complexity and leadership, institutions and values, technology and imagination, information and knowledge, and scale. Resilience relates to the ability of a system to cope with change (Folke 2002). It implies social learning and the ability to develop appropriate practical responses to an emergent condition. A resilient system is a learning system. Adaptive capacity is therefore a measure of the resilience within a system (van Drunen 2011). The key determinants can be understood as conditions that shape and direct the capacity of a social system to effectively negotiate periods of stress and uncertainty.

Complexity

Complex social systems are energy hungry (Christian 2003; Tainter 1988). Highly complex societies are consequently vulnerable to fluctuations in energy. Their complexity also fosters a deep commitment to the infrastructure that maintains their complexity (Ferguson 2010). Choice is constrained by resource dependency and lock-in, which can make systems resistant to forces, either natural or social, that would challenge the dominant order (Casciaro 2005; Diamond 2005). Because complex systems are highly energy dependent, they are often reluctant to redeploy resources to enhance adaptive capacity.

Case study 1: Ancient Rome

The case of the Roman Empire exemplifies these points. Rome's famous roads were not just for its armies but also for drawing the resources of Empire into the centre. The result of Rome's need for bread was to heavily farm both local lands and lands across south west Asia (the modern Middle East) and North Africa. Ultimately, the pressure on farming in all these areas depleted the viability of the lands and led to the collapse in the Empire's ability to feed its citizens (Tainter 1988). This collapse led to a loss of social confidence and considerable social dislocation and was central to the collapse of the Western Roman Empire.

The response of the Roman leadership over this period of agricultural decline was to squeeze local elites for more while giving them less in return. Eventually it was no longer in the interests of these elites to keep propping up a regime that gave them less and less. Yet in the squeezing we can see the desperate attempts of people with power to leverage energy – and in this example bread is energy – from a system by increasing known mechanisms (tax, military intimidation, tribute) for centralising energy flows. The innovation shown by Rome in early years, the example given is of Augustus Caesar and his administrative reforms, is lacking in the last centuries of the Roman empire, where pathway dependency corrals social imagination into inflexible and ultimately self defeating responses.

Practical lessons 1: multi-temporal, open ended, systems thinking

It is tempting to tackle sustainable development as a set of physical and social challenges to human security. However, as Diamond (2005) demonstrates historical analysis indicates that human practice is always culturally and historically determined. Without sufficient reflection, a practical response can be reactive rather than proactive (O'Keefe 2010). Such an insight should strike a note of caution for all of us looking for ways to respond to climate change. For a start, what we consider 'practical' today may lead to problems in the future. As the case of Rome illustrates, simply ratcheting up the known responses to a problem will not necessarily, in the long term, foster sustainability. The 'practical lesson' here is that a new set of conceptual tools is required to determine how to respond to climate change. Many social and technological responses can simply fuel the problem by overlooking the way a dominant paradigm shapes the logic on the ground.

Historical analysis suggests that multitemporal frames are a useful tool when looking for practical responses. Certainly, vulnerable communities and habitats need to be protected today, but medium and longer term thinking also should be engaged. Such thinking needs to frame the 'practical' within open ended contexts that demonstrate a preparedness to innovate, take risks and also develop multiple

responses to an array of possible emergent conditions. Furthermore, complexity points to the need for systems thinking, and the development of tools for handling uncertainty and a questioning of dominant assumptions about viable solutions to an issue such as climate change.

Such responses are profiled by the report in the studies focusing on Sweden's approach to biofuels over past decades and the Brazilian city of Curitiba in the 1990s. Such cases illustrate the practical importance of new social tools such as citizen participation, dialogical leadership, technological and institutional innovation, co-creative community work and the reframing of problems as opportunities. In such contexts, the ability of innovative technologies to bridge the gap between present need and future possibilities is central to a complex system's adaptive capacity.

Technology

Technology has played a central role in all practical responses to change in the past. Its impact on human experience is profound as it shapes both the physical contexts in which humans live and work and the ways of understanding the world. Technology also impacts social identity and social choices with the result that alternatives to dominant constructions of the present can be sidelined or overlooked. Social imagination can challenge such omissions by finding unexpected applications for a technology suppressed by dominant usage and value systems.

Case study 2: the mobile phone

The impact of the mobile phone on modern culture has been immense. It has been the most widespread and rapidly adopted information communication technology ever, with over 4 billion mobile phone subscribers, representing 61% of the global population (International Telecommunication Union (ITU) 2009). The number of mobile subscribers first exceeded fixed-line subscribers in 2002 and the number continues to rise as developing nations rapidly adopt this technology (International Telecommunication Union (ITU) 2009; Srivastava 2002). This rise can be attributed to the social relevance of the technology, which has ceased to be simply a communication device. Not only do mobile phones confer status to their owners, they meet/maintain/generate the need for mobility, freedom, continuous communication and the sense of belonging to networked communities.

The phone consequently fulfils a number of social functions simultaneously: there is the need for connection to friends and family, there is status and identity, there is technological fascination and a desire for novelty, there is also a sense of the power of communication in the broader political sphere where SMS and Twitter are making themselves felt in political demonstrations such as those that occurred in Iran in 2009 and Greece in 2010. Not only is the phone a possibly subversive tool it also is changing social relationships with information and space. Modern phones act as assistants, info portals, global positioning systems and networking devices and are the bedrock of the 24/7 life style. Furthermore, the use of the mobile phone in contexts of historical importance is also changing the way people understand and navigate their world. Examples of such unexpected applications include the mobile's use in the hands of those who died in the 9/11 attacks on the Twin Towers; the role it played as part of the Mumbai Terror attacks where they were used by both terrorists and also those caught in the hotels; and its strategic use in the election of Barak Obama, where material was streamed globally onto the internet.

Practical lessons 2: technology and identity

Human identity is formed through what we do. As what we do is always determined by the technologies that shape our social reality identity is very much a product of the technologies we interact with. We certainly need innovative technology to help us meet the challenges of sustainable development, but we also need to generate a new set of social parameters that generate *innovations in identity*. Examples of identity innovations are the 'Green Consumer'¹ and 'Eco-Parent'². The case of the mobile phone indicates how technological success is linked to emergent possibilities for identity. As soon as a new technology enters the social realm it becomes a player in that realm. In short, technologies are not passive but dynamic and viral social processes.

In exploring the drivers and barriers to sustainable development, we need therefore to work on links between social choices made about technology and the necessary social learning that will underpin any effective response. For example, the multifunctionality of the mobile phone is helping consumers make greener choices when shopping (Heimbuch 2009). A practical move is to link technological innovations with social purposes that promote sustainable activity. This can be done by linking a technology with an individual's identity and choices. Such work involves both the media and marketing and is to be built into the technologies emergence within the social domain.

Because modern societies are so technologically dependent, it is also easy to over emphasise our technology's ability to avert disaster. It is in the interplay between technology and culture that the real work of innovation and change occurs. A heavy reliance on technology when thinking practically can lead to some interesting, imaginative and innovative results – terra-forming and geo-engineering work (Ghosh 2009), Masdar Dubai (The Economist, 2008) – but often ultimately perpetuates the same cultural habits that created the problem. It was noted above that cultures carry the seeds of their own destruction. The case of Angkor Wat, situated in modern Cambodia, is a good example of what can happen when a civilisation fails to confront their dominant assumptions and the technologies these are linked with. It is presented here to illustrate Practical Lesson 2.

Case study 3: Angkor Wat

This medieval civilisation was dependent on the control of water. In fact, archaeologists refer to it as a hydraulic urban development (Higham 2003). Over centuries of monsoonal rain, the Khmer people of Angkor Wat were forced to extend and modify their hydraulic technology of locks, canals and water wheels in response to heavy erosion. Over this time, they also continued to modify the technical infrastructure of their society; intensifying the activity (deforestation, canal irrigation) that was actually undermining the viability of their agricultural system. At no time did they consider altering the basic principles and premises upon which their society was founded. Theirs was a hierarchical, regionally aggressive, authoritarian, theocratic state and although they demonstrated considerable technical flexibility, ultimately they could not maintain the agricultural base of their society. Collapse was quick to follow.

¹ See: http://www.gdrc.org/sustbiz/green/doc-cons_vitalsigns.html

² See: <http://au.lifestyle.yahoo.com/practical-parenting/toddler-preschooler/article/-/7589931/eco-parenting-green-play/>

Leadership and institutions

The SEQCARI report focused on authoritarian and adaptive leadership. Two studies (Easter Island, Azerbaijan) profiled authoritarian leadership as likely to foster short term maladaptive responses to climate change. Such leadership tends to reduce creativity and the sense of agency in its citizens, communities and institutions. The exception was the case of Cuba's response to the collapse of the USSR, where authority stepped back and allowed a degree of freedom to respond creatively to what essentially constituted a mini-peak oil experience.

The study focused on what we call adaptive leadership, following Heifetz (2009). Such leadership is open, respectful, imaginative, engaged and prepared to take risks to ensure that a broad community of stakeholders benefit from social renewal. It also suggests that adaptive institutions emerge over time and only through collective effort. Institutions are social products designed to solve perceived problems with the ordering and maintenance of society. Adaptive leadership understands how to develop and foster adaptive institutions as the case of Solon in ancient Greece demonstrates.

Case study 4: Athens 590 BCE

At the opening of the 6th Century BCE, the city-state of Athens was struggling with social unrest, economic decline and the violent rivalry of its wealthier citizens. Leadership was contested and usually factional. The city's status, prosperity and security were all threatened. The Athenians turned to a trusted member of the aristocracy, Solon. He was elected chief magistrate (*archon eponymous*) of Athens in 594, BCE. In this position, Solon instituted a number of sweeping reforms (Rhodes 2006). The reforms were counter to the interests of Solon's own class. To ensure that he was not compromised by his position once the elected period was over, Solon went into voluntary exile for ten years.

At first, these reforms were not that effective and Athens again had to endure a period of tyranny under Solon's cousin Peisistratos. However, the reforms laid the foundations for the emergence of Athenian democracy later in the century. In this example, we see that social learning takes time. Solon prepares for a future democratic Athens by sowing the seeds of an idea and setting up the institutions that over time gain strength, legitimacy and ultimately authority. Solon's idea bore practical results in the form of a democratic polity that managed rivalry and shaped identity in a way that avoided the worst of factional and competitive violence.

Practical lessons 3: patience, memory and vision

It took a century for Solon's ideas to catch on. Change always experiences a period of up take when it is an emergent trend (one amongst many) before it gains momentum and legitimacy (Inayatullah 2008). This case study is a reminder that patience and persistence go hand-in-hand with vision and courageous leadership. Social memory is also important because people had to remember what it was that Solon had sought to establish. The democratisation of Athens also flags the necessity of building the institutional infrastructure and conceptual tools in anticipation of a desired change.

Practical responses therefore inhabit all four quadrants of Figure 1 presented earlier in this paper: we need responses now (upper right), institutional preparedness both now and into the future (lower right), cultural ferment in which new ideas, values and language are sown through effective leadership

(lower left), and also individual ownership of this cultural ferment (upper left) for sustainable futures to be even considered a viable possibility.

Case Study Synthesis: the historical scenarios

Such historical reflections are crystallised in the report into four broad scenarios based on the work of futurist Jim Dator (Dator 2002). These scenarios are intended to stimulate discussion and reflection for stakeholders who are taking part in the broader SEQCARI project. The overall intention of the research initiative is to foster better institutional and personal understandings about adaptive capacity in relation to climate change. The goal is to empower stakeholders and thus strengthen resilience across South East Queensland. In this the use of scenarios is a stimulus for anticipatory action learning (Inayatullah 2007).

Scenarios are a key tool for fostering such learning (Inayatullah 2009). They do this by suggesting alternatives, challenging dominant constructions of the present and allowing people to develop visions of the future that are aligned to their own aspirations as individuals and communities (van Drunen 2011; Crivits 2010; Heugens 2001; Chermack 2004). Scenarios they challenge linear constructions of social process and affirm human agency – our ability to act on the present – by highlighting our centrality as social actors (Inayatullah 2009). Finally, as Chermack (Chermack 2004) has argued scenarios can inform decision making and reduce the instances of folly with which history abounds.

Thinking about possible drivers and barriers to sustainable development becomes more reflective when it occurs in conjunction with scenarios. Dator (2002) has been working with scenarios for over thirty years and suggests that for all the variety available to scenario planners, there are in fact only four archetypes: **continuation** or business as usual; **collapse** in which a society loses coherence and returns to a less complex form of social order as happened following the fall of Rome; a **disciplined society** that adheres to a strict social or spiritual/religious ideology such as in feudal Europe, communist North Korea and Taliban dominated regions of Afghanistan; or **transformation**, in which context experiences a qualitative shift to another level of social order as occurred when Western society moved from an agricultural to an industrial society.

Practical lesson 4: probable, possible and preferable futures

Scenarios challenge our thinking about the present. One of the difficulties faced by decision makers is to really engage with medium and long term thinking. The present simply seems too dominant, *too real*, for any considerations about an open ended future to be relevant. Such 'strategic inertia' (O'Keefe 2010) is a real barrier to effective action in the area of sustainable development. Historical reflection and the scenarios distilled from this analysis offer powerful evidence that longer term thinking is very much to the advantage of those locked in a struggle to ensure viable and sustainable social and economic structures into the future.

Scenario work is slanted towards preferable futures. Futures thinking seeks to navigate through probable futures to possible futures and ultimately to futures that are deemed by those in the context to be preferable. Such partisan work is ethically valid as long as everyone agrees to **owning** the process. In the case of Dator's four scenarios, we can see that Scenario 1: Continuation is for many of us preferable, and may, with some technical ingenuity even be possible, though probably unlikely; Scenario 2: Collapse and Scenario 3: Disciplined Society are both possible, they may even be probable, but certainly they are

not preferable. Scenario 4: Transformation for many might be considered preferable but may also be considered neither probable nor possible. The lens we choose to apply to these scenarios will determine responses and reveal to participants their fundamental value orientation: optimist, pessimist, or pragmatist. It is therefore important to consciously pick the lens most appropriate to the context. It should be sufficiently grounded to offer practical engagement, sufficiently empowering to offer hope and a pathway to success, sufficiently real to focus attention and sufficiently sobering to demand immediate action.

One final case study: Britain 1800

The industrial and political elites of Britain in and around the year 1800 developed a vision for their preferable future. This vision required considerable social will and institutional creativity. To develop an industrial and capitalist system required new laws, new institutions, a rethinking of political structures and processes, the turning upside down of the settled agricultural world of the majority of Britons, and an extensive and rapacious, but also seductive, Imperial system. This work took place mostly between 1750 and 1850 and can be considered completed with the 1851 Great Exhibition at the Crystal Palace in London, which enshrined the vision and imagination of the new industrial epoch.

The social suffering of the majority seemed, in the short term, a small price to pay for the longer term dividends these elites hoped to receive. This work was certainly both practical and risky. It was also a work of great social imagination. The effects were immediate and once unleashed almost uncontrollable. The Luddite rebellion of 1811-1812, the Swing riots of 1830 and the near revolt of 1848 all point to the immense unrest that these changes elicited from the British populace. It was in this period that the working class was 'invented' along with the factory and the notion of 'capital' (Hetherington 1997).

Practical lesson 5: imagination and will

What stands out in this historical case study is that imagination needs to be coupled with social will, institutional creativity and empowered leadership if deep and lasting (i.e. sustainable) change is to be achieved. If we frame practical responses in an instrumental and reactive context, the results will only buy a sinking ship additional surface time. For deeper transformative and preferable futures to emerge, there needs to be a deep engagement with the imaginative and structural bedrock of our civilisation (see for examples: Milojević 2005; Eisler 2007). The British case study illustrates how such sustained proactive social engineering occurs. Without such an engagement, all our work will tend to be reactive and cosmetic in nature.

3. Summary

The historical case studies and the scenarios they generated have been designed to stimulate reflection on how best to respond to climate change within the contexts of human settlement and health; energy; agriculture, forestry and fisheries; and biodiversity and ecosystems. These reflections have been summarised in Table 1 and some practical responses are offered.

Table 1: Summary of practical lessons	Observations	'Practical' responses
Practical lesson 1	Move from reactive to proactive	<ol style="list-style-type: none"> 1. Apply and develop tools for reframing issues 2. Take calculated risks 3. Apply systems thinking 4. Social tools involve citizen participation, dialogical leadership, institutional and technological innovation, community networking
Practical lesson 2	<p>Technology and Identity are linked - Technology becomes a social agent once it is created</p> <p>Technology can foster a false sense of security</p>	<ol style="list-style-type: none"> 1. We need innovative technology that links with innovative identity 2. Work on social choices made about technology 3. Cultivate identity between a technology and its utility as a response to climate change
Practical lesson 3	<p>Social process can be represented across four quadrants thus 'Practical' is a shifting signifier</p> <p>Adaptive leadership fosters adaptive institutions</p> <p>Adaptive institutions emerge over time and only through collective effort</p>	<ol style="list-style-type: none"> 1. Change takes time but needs effective leadership 2. Institutional building needs to anticipate the desired change
Practical lesson 4	Scenarios challenge our thinking about the present	<ol style="list-style-type: none"> 1. Use short, medium and long term thinking 2. Use scenarios to challenge constructions of what is possible 3. Be clear about value base and base choices and responses around these 4. Don't be shy about promoting preferable futures
Practical lesson 5	We need to couple imagination with social will, institutional creativity and empowered leadership	<ol style="list-style-type: none"> 1. There needs to be a deep engagement with the imaginative and structural bedrock of our civilisation

Most practical responses outlined in this paper involve combinations of social, technical, cultural and personal responses that are relevant to the pressing issue of climate change. The four quadrant depiction of these interrelated spheres is our attempt to capture the dynamic backdrop to thinking about this. The term 'practical' thus becomes a moving signifier that carries different implications across the four quadrants. Figure 2 illustrates how this works and goes some way to challenging the separation of 'practical responses' into various domains of action. From the historical perspective, technology and culture go hand-in-hand and mutually reinforce one another.

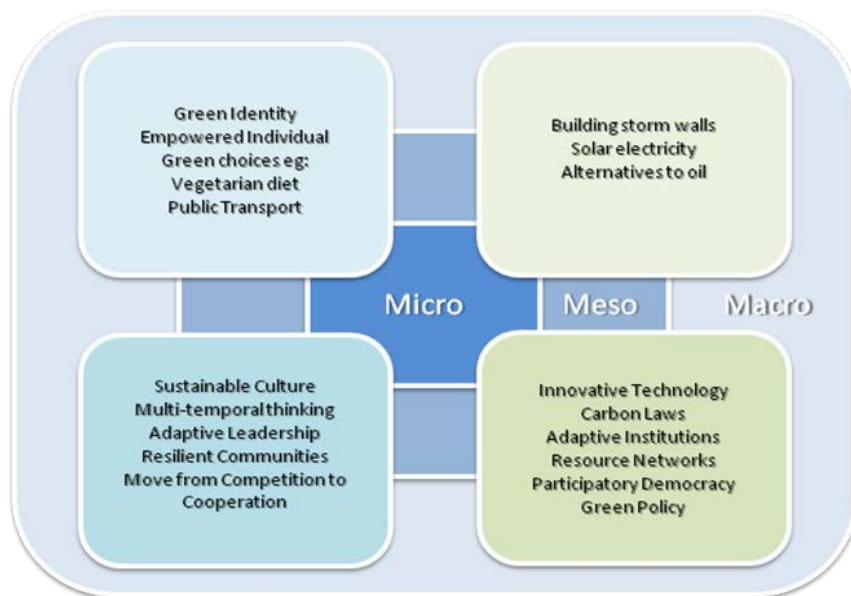


Figure 2. Practical responses across the four quadrants

4. Conclusion

Historical thinking demands a sensitivity to time frames that have a futures orientation. In short, we need to assess short, medium and long term benefits arising from any practical response. In working through such considerations, historical thinking brings depth and also inspiration. We can see that human history is not simply a litany of failure and collapse. In the stories of Ancient Greece and Rome we find innovative and creative thinkers, flexible institutions and courageous populaces all ready to experiment with their world to increase human possibilities and lower risks. In this way, history also challenges us to consciously live in the present by examining other times and places in which individuals and groups worked to improve the security and stability of their worlds. History looks at human action, and the choices that drove this action, so that we can think beyond our past and act rather than react to challenges such as climate change and sustainable development.

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MEASURING ENVIRONMENTAL SUSTAINABILITY AMONG UNIVERSITIES

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1. Introduction

Higher Education (HE) is facing one of the greatest challenges in meeting its responsibility to provide the knowledge and educated citizenry that will lead to a sustainably thriving civil society. Sustainability is becoming an integral part of university life. A global trend among universities shows that they are revising their missions and strategies by embodying sustainability on their agenda. Furthermore they have been restructuring the courses and research programs as well as technical operations on campus to include sustainability in their perspectives (Wals, 2004). The long list of signatories of various declarations which promote sustainability in higher education is another proof of this change. The Talloires Declaration, The COPERNICUS Charter and Luneburg Declaration are some examples.

Environmental sustainability (ES) as one of the main pillars of sustainable development has appeared to be a global challenge. The emergence of ES in HE is a relatively new phenomenon. ES declarations, specifically advanced for HE, emerged in the early 1990 (Wright, 2004). These declarations appealed to colleges and universities to take environmental concerns into consideration within the general framework of institution. The emphasis is not only on daily practices and technical operations but also on governance, education, research activities and community services at the universities. The idea of universities morally are obliged to become the model of ES has root back in ES for HE declarations. Therefore universities which have been signed the declaration, have given a pledge to show their commitment by implementing ES in their policies and practices.

Analyzing universities commitment to the declarations and in general to environmental issues can clarify the role of universities in dealing with such a global challenge. Given that ES for HE is a new field, efforts to benchmark universities' responses to quest of ES are very scant and limited. Benchmarking is a search for the best practices that lead to superior performance. This study conducts a systematic method to measure performance of the University of Oslo (UiO) with regards to ES commitments against 20 international research universities.

2. Background and Literature

Sustainable Development and Environmental Sustainability

To define ES, it is necessary to look at the broader frame of Sustainable Development (SD). The term of Sustainability has a variety of definitions depending on the context which it is used. Dobson, (1996) collected three hundred definitions for terms of sustainability and sustainable development. Wals and Corcoran, (2004) presume that multiple definitions for sustainability should not be consider as weakness since it gives the opportunity to define the term depending on the context which is by self, a meaningful learning.

The concept of sustainable development according to the 1987 World Commission on Environment and Development means “development which meets the needs of the present without compromising the ability of future generations to meet their own needs.” It refers to three mutual reinforcing pillars which are Economical, Social and Environmental development. Therefore the development will be bearable, equitable and viable. In another word, SD is an interrelated cohesive concept. The Brundtland Commission (1987) explains SD as a process of change with a futurist approach. “a process where the exploitation, the orientation of technological development and industrial change, are made consistent with future as well as present needs.” Hamm and Muttagi (1998) argues that sustainability is not a concept aiming at static paradise but it refers at capacity of human, by means of social organization, to adapt to their non-human environments. Scott (2002) defines the term as SD is a learning process through which we can learn -or choose to learn building capacity. The capacity enable human to live more sustainably. Therefore SD is a process and the goal is sustainability. Sustainability refers to conservation, protection and regeneration of recourses over an indefinite of time. Central to sustainability is the fact that what we decide at the present time affect the future of human well – being, environment and the economy.

Munasinghe and Swart (2005), argues that since human welfare ultimately entails ecological recourses therefore ignoring their limits enhance the risk of undermining the long-term prospects for development. They perceive that ES concentrates on the overall viability and health of ecological systems in a comprehensive and systemic way. Moore (2005) expresses that SD is the reconciliation of social justice, ecological integrity and well-being of the entire living system.

According to the United Nations Development Group (2009), ES is about meeting human needs without undermining the capacity of the planet’s ability to support life. However, it emphasize that there is no common guide to define the ES at an operational level. ES is also has been defined as the process of observing and reconstructing the human interaction with the environment. The process signals the ideal behavior which enables us to keep environment pristine as possible. It is important to ensure the earth’s life-support systems including atmosphere, the oceans and the land are maintained properly and get repaired after any damage. (Moffatt, 2001) Some studies framed SD particularly in relation to the environment. Foster (2005) for instance; define SD as a process of making the emerging future habitable for human with a resistant environment. He stresses that this process of improving human condition can be achieved through continuous responsive learning. Therefore we can say that a sustainable

environment is the one in which life/sustaining process and natural resources of the earth are conserved and regenerated to be served the present generation as well as the future ones.

Education for Sustainable Development (ESD)

ESD as an education tradition was developed in early 1990. The United Nation Conference on Environment and Development (UNCED) in 1992 and Agenda 21 UN are the main legacy behind the concept. Ohman and Ostman (2003), place a certain amount of influence from globalization of economy in advancing ESD as well. Chapter 36 of Agenda 21 entitled 'Promoting Education, Public Awareness and Training' addressing education as a critical means for promoting SD. The chapter arrays a set of objectives in accordance with education, awareness and training for improving the capacity of the people to inherit environmental issues. According to the objectives countries are assumed to develop their priorities accordingly and implement the relevant policies, strategies and programs to meet the above mentioned objectives. In connection with UN decade of ESD, spanning from 2005 to 2014, UNESCO has provided the characteristics of requested education. The vision is 'a world where everybody has the opportunity to benefit from education and learn the values, behavior and lifestyles required for a sustainable future and for positive societal transformation' (UNESCO, 2005).

Chronology of Environmental Sustainability Declarations in Higher Education:

The notion of sustainability in higher education for the first time was addressed internationally by the UN UNESCO-UNEP International Environmental Higher Education Program in 1978. After this even a number of international, national and regional declarations relating to HE and environmental sustainability have been issued. These declarations have been signed by numerous HEIs. Here I briefly review the evolution of ES Declaration in HE.

The Stockholm Conference on the Human Environment in 1972 drew attention to SD and its relevancy to HE. The Stockholm Conference stresses on interdependency between human and the environment and role of educational institutions in providing environmental education for all ages. The Declaration called on all educational institutions to 'broaden the basis for enlightened opinions and responsible conduct by individuals, enterprises and communities in protecting and improving the environment in its full human dimensions' (UNESCO, 1972, Principal 19). UNESCO-UNEP Intergovernmental Conference on Environmental Education in 1977 stated that 'Universities as centers for research teaching and training of qualified personnel for the nation, must be increasingly available to undertake research concerning environmental education and train experts in formal and non-formal education.' It also clearly stresses on environmental education for all students regardless of their majors. 'It is necessary for students in all fields, not only natural and technical sciences but also social sciences and arts, because the relationship between nature, technology and society mark and determine the development of a society.' Wright 2004, refers to the Belgrade Charter (1975) and the Tbilisi Declaration (1977) as influential events in the development of international environmental education and sustainability initiatives which asked universities to consider environmental education in curriculum and engage faculty and staff in the process. In addition, they suggest universities to provide specialist training, involvement in regional and international related projects and educate community and public

about environmental challenges. Scott and Gough 2004, consider the World Commission on Environment and Development (1987), influential events particularly for introducing the terminology of SD. It has been recognized as a ground for further work such as IUCN 1990; Caring for the Earth initiatives which introduced a strategy for Sustainability. This strategy followed and developed into chapter 36 Agenda 21 in 1992 during Rio Earth Summit and the United Nations follow up conference.

Chapter 36 Agenda 21 of the United Nations Conference on Environment and Development in 1992 explicitly focuses on education, training and awareness with regard to environmental issues within educational institutions. It has urged for reorienting education towards sustainable development. It emphasizes on education as a critical means for promoting SD and improving the capacity of the people to address environment and development issues. It calls on all countries and recommends that 'Governments should drive to update or prepare strategies aimed at integrating environment and development as a cross-cutting issue into education for all levels within the next three years...A thorough review of curricula should be undertaken to ensure a multidisciplinary approach, with environment and development issues and their socio-cultural and demographic aspects and linkages.' In addition to that, Agenda 21 has urges universities on being actively involved in education, research and raising awareness with regards to environmental challenges; 'Educational authorities should promote proven educational methods and the development for innovative teaching method for educational setting...Countries could support universities and other tertiary activities and networks for environmental and development education. Cross-disciplinary course could be made available to all students. Existing regional networks and activities and national university action which promote research and common teaching approaches on sustainable development should be built upon, and new partnerships and bridges created with the business and other independent sectors, as well as with all countries for technology, know-how and knowledge exchange.' The agenda also encourages educational institutions specially HEIs to contribute more to awareness and capacity building. In addition, the document remind institutions 'to ensure that environmental and human ecological considerations are integrated at all managerial levels and in all functional management areas such as marketing, production and finance.' The last part of chapter 36 encourage universities to take responsibility in community outreach as well as providing non formal education , vocational and management training within environmental frame as community service. This chapter urges university to set their operational standard in line with environmental friendly criteria.

Specific declarations for HE and sustainability emerged at the early 1990 and continually evolved through decades until the present time. One of the main motives in preparing such declarations is that HEIs encountered the world concerning about environmental issues. Wright 2004 explains that HEIs were looked upon by the society as a place of preserving, creating and implementing knowledge and truth. Therefore it was expected from these institutions to imply the appropriate knowledge and values to deal with the complex problem of society. She also points at the criticize which university received on their inability to be model of sustainability in operating the infrastructure and technical endeavor environmentally friendly as well as lack of environmental curriculum.

The Talloires Declaration: in 1990 as a result of the conference held in the Tufts University European Center discussing role of HE in an environmentally sustainable future, the university leaders issued the declaration. They expressed that the universities has a major role in the education, research, policy formation as well as exchanging knowledge and information in order to make a sustainable future

for all humankind in harmony with the nature. They called on faculties, administrative staff and students to contribute for achieving this goal. In addition they recommended 'creating programs to develop the capability of university faculty to teach environmental literacy to all undergraduate, graduate and professional school students.' It also encourages universities to 'convene deans and environmental practitioners to develop research, policy, information exchange programs and curricula for an environmentally sustainable future.'

The Halifax Declaration: the conference on University Action for Sustainable Development was held in Halifax in 1991. The main objective of this conference was about role of universities in capacity building to address environmental issues as a follow up to implement the Talloires Declaration in Canadian universities. This declaration provided an action plan for universities to follow. The plan has set for short and long term achievement to work toward SD. The Halifax Declaration morally obliged universities to take responsibility toward environmental challenges.

The Kyoto Declarations: it was declared at the Ninth International Association of Universities Round table in 1993 and was adopted by 90 international university leaders. The declaration advises universities to promote ES in education, research and physical operations (Wright, 2004).The declaration encouraged universities to take a certain actions including promoting environmental literacy, community outreach, industry and government partnership, sustainability research and Eco-friendly physical operations.

The Swansea Declaration: in August 1993, participants in the Association of Commonwealth Universities 15th Quinquennial Congress at the University of Wales gathered to respond appropriately to the environmental challenges. The main theme of this Congress with participants from 400 universities from 47 countries was 'People and the Environment- Preserving the Balance'. The declaration reiterated most of the objectives which issues in the previous declarations. In addition to them, it stress the issue of equality among countries as a crucial point toward a sustainable future and requested the universities in the more fortunate countries support the less fortunate countries HEIs to achieve their environmental sustainability objectives.

The CRE Copernicus Charter: it was created by Co-operation Program in Europe for Research on Nature and Industry through Coordinated University Studies in 1994. This program was established by Association of European Universities. It was an effort to evaluate and follow up the other declarations as well as Agenda 21 to develop universities efforts and understanding of sustainability. The charter was signed by 213 European university rectors who aimed at making universities as an influential actor for creating sustainable societies. It emphasized on technology transfer, public outreach, Environmental literacy program, developing environmental ethics, collaboration and partnership with other sectors of nations to achieve ES.

The Thessaloniki Declaration: It was after the UNESCO Conference on Environment and Society with regards to Education and Public Awareness for Sustainability in 1997. It urged universities to not only consider Es on their educational program but also in various dimension of HEIs such as research, operation, public outreach. It also called for government to support and prove their commitments which they have made in the previous declarations.

Lunenburg Declaration: it stated as a result of the Higher Education for Sustainability- Towards the World Summit on Sustainable Development Conference (Rio+10). The declaration was drafted by members of the Global Higher Education for Sustainability Partnership. It emphasizes on

interconnectedness of globalization, democracy, social justice, human right, peace and environmental protection in relation to HEIs. It requested universities for developing their toolkits for make an operational definitions and action plan from the statement which they have signed. It also emphasize on importance of empowerment of all people to work together toward a sustainable future.

3. Methodology and Design

50 indicators for measuring ES commitment at the universities were designed based on The Luneburg Sustainable University Project in international comparisons, content of ES declarations and Sterling Model (2004) for operational dimensions of an Educational Institution. The indicators classified under 5 categories: Governance & Administration, Curriculum & Study opportunities, Research & Innovations, Operation & technical practice, and other related activities.

20 universities have been chosen as sample of study which include the top 10 universities according to Times Higher Education (THE) Ranking 2009 since UiO has ambition to be one of leading universities in years to come. They are Harvard University, Cambridge University, Yale University, UCL (University College London), Imperial College London, Oxford University, Chicago University, Princeton University, MIT (Massachusetts Institute of Technology), CALTECH (California Institute of Technology). There are 4 universities, listed as the same level as UiO in bibliometric indicators which are Australian National University, University of Tokyo, Bristol University, and University of Copenhagen. 3 more universities is included since they recently have received Green award recognition; British Columbia University, Gothenburg University, Bradford University. In addition, Environmental Sustainability of 3 Norwegian universities have been analyzed in the study: University of Bergen (UiB) , Norwegian University of Science and Technology (NTNU), Norwegian University of Life Science (UMB).

During June to September 2010 the websites of all 20 universities in addition to UiO website have been studied carefully in order to obtain the relevant data. Requests for more information and guidelines have been sent to the universities when necessary. Since international *visibility* of ES in universities is one of the criteria, the main source of study has been the English website of universities in countries where English is not the first language (case of: Scandinavian universities & Japan). However, due to a lack of adequate information on the English websites of Norwegian universities, the Norwegian version has been reviewed as well and requests for more information have been sent to these universities. Each university has a table (Table 1) which shows its commitment to every provided indicator. 50 indicators for each university have been observed and marked in the table.

Table 1. Indicators for measuring ES at the universities

Governance and Administration	Curriculum & Study opportunity	Research	Operation	Other related activities
Staff position / Sustainability office	Undergraduate study in Environmental Sustainability	Research Centre / Institute	Energy	Conferences
Policies / Principles/ Strategy	Postgraduate study in Environmental Sustainability	Internal Grant Opportunity	Carbon emission	Students group
Institutional declaration/ Resolutions	Doctoral studies in Environmental Sustainability	External Funding	Waste Recycling	Events (except conferences)
Strategic approach/ Action plan	Environmental Sustainability Education	Research Collaboration with Industry & Corporate	Building	Community Projects
Internal Awards	Multidisciplinary Sustainability Education	Journal	Purchasing	University-Community Partnership
Annual Sustainability Reports	Service Learning	Communication within Research Centres	Water	Website of Sustainability centre/activities
Students levy	Student Research	Other research Activities	Food & Dining	Media/ News from Sustainability of University
Audits	Climate Change	Climate Change	Paper	External Awards and Recognition
			Housing	Campus tour & Flyers

It is important to mention that this method does not include using an interval scale for each criterion to show the level of commitment. Rather it shows if a university's system cover any of the indicators. In other words, it represents an absence or presence of activities occurring at a university.

Conclusion

The analysis of the data in Chart 1 shows the overall commitment of universities to ES. The highest mark is 48 out of 50 indicators and moves downward to 18.

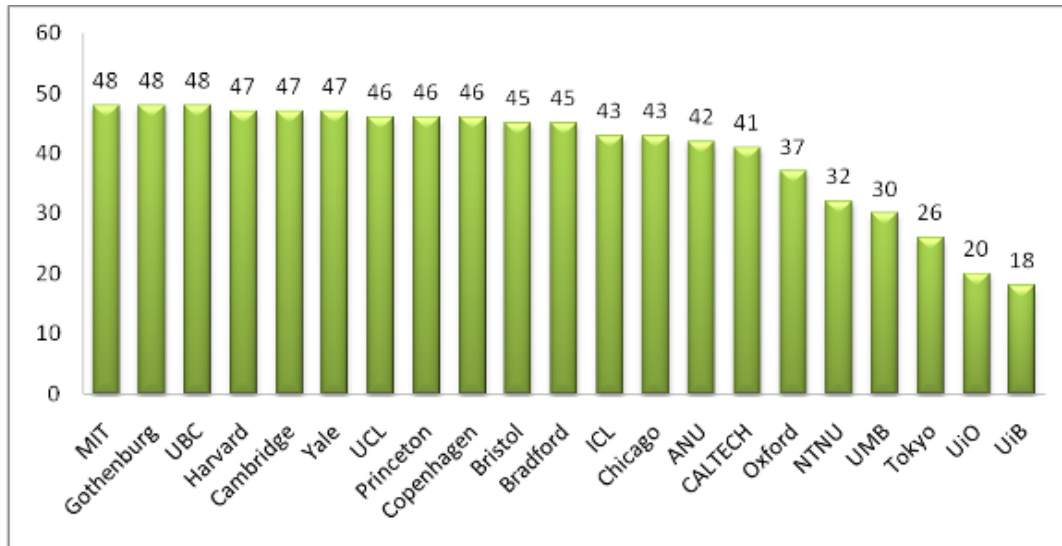


Chart 1. *Universities' Commitment to the 50 Indicators of Environmental Sustainability*

Over passed decades, a general accreditation on the notion of education for SD as an important tool in achieving change has been evolved. It has been proposed that in order to satisfy the need of education as change agents, the existed educational provision must be modified. Education as change agents should cover the recognized need for professionals and learners and empowering them to press sustainability challenges effectively (Mochizuki and Fadeeva, 2010). It also has been emphasized on Agenda 21 that formal and informal education in all levels are indispensable to raise awareness, change attitudes and enable people to address their environmental responsibility and take the necessary actions to tackle the current challenges and prevent the possible ones. It is important to stress that the term of education is not about a monologue tradition of one teaches and the other learns but it embassies on a dynamic and interactive process of learning. Scott (2002) argues referring ESD as a learning process makes it clear that we do not have much emphasize on teaching. One reason for that is ESD should do beyond schools and university systems. It has capacity to promote ES through non-formal and informal education as well. However as it has mentioned above, to implement ES in education we have to consider to undergo a change in education. O'Riordan (2004) addressed that the current curriculum at school and HD institutions is geared toward unsustainable economy and society. The educational philosophy and systems worldview of these schools and institutions promote a non-sustainable approach of economical and social growth which encourages resource depletion and uncontrolled use of natural environment. Orr (2009) forthrightly claims that the problem is not in education but it is of education. He continues that the learning disciplinary predominated by deep beliefs that human are separated from the rest of the nature and the whole planet is a gift to them which will keep providing them all the resources regardless of human pattern of interaction toward the nature. Therefore the need

to understand the nature of sustainability and the concept of ES will remain until we develop a set of belief and promote attitudes which will be in favor of a sustainable society. The concept of sustainability calls on the kind of educational philosophy that trains human resources to optimize productivity by obtaining accurate technical progress. In addition it has to promote the cultural conditions conducive to social and economical change which consent to obtain the desired growth with elimination of harmful impact on the environment (Pidlisnyuk,2009). Thus the change has to be created within philosophical framework of current system and eventually distributes the culture of sustainability within its organizational and institutional life as well as the whole society. I shall add here that although SD and developing curriculum are theoretically separated but empirically they are interweaved. Thomas 2009, compare these concepts and numbers their common points. He expresses that they both include time span and promote change as well as leading to beneficial results. Therefore the appropriately designed curriculum means that implementing SD in schools and HEIs is achievable in a closer era.

However the new approach in curriculum provides better study opportunities and understanding in line with SD and particularly ES but the technical operation of universities have to be according to ES standards and criteria as well. Thus we should build up whole picture of process based on the combination of various dimension of HEIs operations. Without a doubt, environmental knowledge and public awareness are important factors which influence environmental policy and management in a society. Therefore to have a successful environmental sustainability in a country in general and at higher education institutions particularly, there is a need for capacity building and raising awareness. However one can claim that raising awareness, capacity building and behavioral change are what expected to take place at and within these institutions.

One of the main factors for stepping up level of commitment to ES in HEIs in some studies is National policy. Although I agree on essential role of state in promoting sustainability and facilitating this process for organization including universities but studies show that governments are one of the actors. Janicke 1997 referring to OECD Report 1992 argues that failure or slow progress in environmental policy cannot be explained solely by the wrong choice of instrument or strategy by government. Culture and the value system in a country are also highlighted in studies on environmental policy. Moreover the level of freedom that university governance system for instance in Norway obtains is by far more than many other centralized systems. Therefore if environmental sustainability be introduced or appreciated by university leadership as well as academic staff and students a change in institution level might be very likely. Carraro, 1999 argues that the performance of voluntary agreement can be analyzed across several dimensions. He introduced several factors such as environmental effectiveness, implementation effectiveness, cost effectiveness, stimulation of innovation, feasibility and competition. The University of Oslo as another example which has stepped up its environmental sustainability levels. Environmental effectiveness, cost effectiveness and competition to achieve a higher status among other universities are some important factors which have motivated UiO in this process. To conclude the argument, the combination of state support, legitimate policy, cultural awareness and voluntary approach can be consider as an effective solution to elevate the current position of Environmental Sustainability to a better place among HEIs and particularly Norwegian Higher Education Institutions. Furthermore students should feel empowered and demand their right for having Greener universities. However let us remember that for every right that human claim, they should take responsibility as well.

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DESIGNING SUSTAINABILITY TOGETHER - DISCIPLINARY COMPETENCES IN TRANSDISCIPLINARY KNOWLEDGE BUILDING

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ABSTRACT – *Sustainable development requires a trans-scientific approach. Similarly, sustainable design requires insight from several professions, and systemic understanding on stakeholders and their interests. This article explores previous research on transdisciplinarity, and new data that is gathered with questionnaires from a multidisciplinary master's study programme. It is positioning further research and development in design teamwork between multiple disciplines, and it aims to identify the necessary approaches to collaborative and transdisciplinary knowledge building for sustainability.*

1. Introduction and Background

Sustainability can be generally understood as an approach to design and development "that focuses on environmental, social, and financial factors" and is about "balancing" and "mediation" between different ideas and concepts (Shedroff 2009, 5). Research, and similarly design on sustainability require the participation of different experts from several disciplinary fields, and therefore must also have a trans-scientific character (Tukker et al. 2008). Transdisciplinarity has become "a label for collaborative research" in sustainable design, crossing over disciplinary boundaries and sectors of society (Bruun et al. 2005), and gradually deepening the integration in communication and knowledge between the participants (Hukkinen 2008).

This article looks into how students in design, engineering, architecture, real estate and economics approach sustainability, and explores the differences between disciplinary approaches and understanding. It aims to position the approach to multi-professional design collaboration better, and studies the emphases that should be used in such process from the scope of sustainability, but also from the perspective of transdisciplinarity. Data is gathered with questionnaires from students in a new multidisciplinary master's programme called Creative Sustainability (CS), which started in Fall 2010 in Aalto University. The programme's curriculum has strong emphasis on collaborative courses and real-life cases, and as such it represents a good example to study transdisciplinary knowledge building.

2. Theory and Literature

To achieve excellence in education for sustainability, it is necessary to promote interdisciplinary knowledge building (European Commission 2003), and the disciplinary competences and perspectives have to be re-evaluated. Design, and sustainable design even more so, is merging values and knowledge between domains of society, as it must address "several dimensions of stakeholder activities and systemic levels related to the product or service" (Shedroff 2009, 5).

Co-operation is the foundation on which innovations occur (Ibid., 12). This, however, puts emphasis on the framework for collaboration. How could this framework be designed in such a way that it would promote innovation, but at the same time orientate the collaborators and their disciplinary perspectives towards more sustainable outcomes?

Balancing sustainability

Sustainable design should weight different possibilities in three different dimensions of sustainable development, as is visible in the famous diagrams that link the ecological, economic and sociocultural aspects. These dimensions can be perceived to interact equally, or then hierarchically (see Fig. 1).

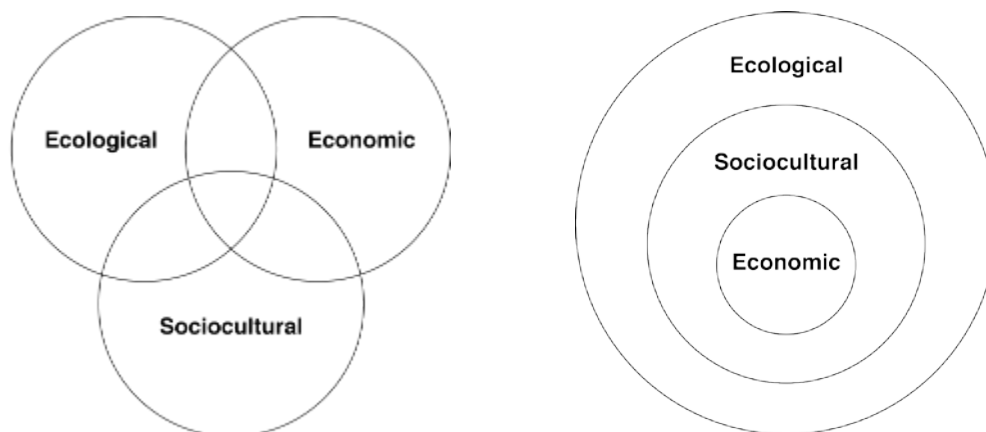


Figure 1 The triangular versus the "nested" model for sustainable development (Source: Gidding et al. 2002)

The traditional triangular model that is separated into three different areas, "often leads to a narrow techno-scientific approach" (Gidding et al. 2002, 187). In hierarchical or "nested" sustainable development, on the other hand, the "economy is dependent on society and both dependent on the environment" (Ibid., 192). A systems perspective requires appreciation and understanding "in regard to the interaction between various systems" in the three dimensions of sustainability (Shedroff 2009, 5), and one should bear in mind this hierarchy of these dimensions, and the fact that the sociocultural – not to mention the economic aspects – should still follow the limits of the ecosystem.

At the same time the systemic order of the focus areas from the nested approach helps to prioritize the compromises that have to be made during the design processes. Sustainable design focuses on solutions that are better for society, environment and economy, but in the end the selected focus dictates the order of things. To follow the systemic approach, a team should first iteratively assess their shared

understanding of the task, then both socio-economic (stakeholders) and ecological systems (ecological feasibility), and then adjust their concepts according to these.

The need for transdisciplinarity

In the creation and development of transdisciplinary processes that involve higher education and society, different actors are increasingly engaged from the realms of business, scientific research, and politics (Nieminen 2004, 26). "Wicked" problems require "integrated and flexible design solutions" that are adapted to the "eco-social complexity of their scale-linking context" (Wahl & Baxter 2008, 75). In a complex system "collective and inclusive decision-making" helps to develop more sustainable solutions, as it is "informed by a broader knowledge base" (Ibid., 76). Transdisciplinarity aims into a similar knowledge creation process.

The processes of collaborative work between professionals from different fields range from cross- or multidisciplinary to interdisciplinary and eventually to transdisciplinary, gradually deepening the integration of knowledge, communication and values between the participants and the society (Hukkinen 2008; Bruun et al. 2005). This integration of knowledge has to occur at the level of defining goals, choosing or creating a common framework for communication, agreeing on ethical standpoints, and forming a shared vision (Hukkinen 2008, Després et al. 2004). At the same time the abilities to translate and analyze disciplinary frameworks and concepts become important, because without a mutual understanding and agreement on visions, scenarios and problem-setting true progress cannot be made (see e.g. Marttila and Kohtala 2010).

Merging the professional knowledge

In the transformation from the traditional multi-professional design collaboration towards transdisciplinarity the value systems are gradually integrated, and the emphasis is on application. The aim in the process is in acquiring an "integral vision": a framework for understanding, acknowledging, and weaving together different perspectives and worldviews (Wilber 2001; as in Wahl & Baxter 2008). The merging of professional knowledge for transdisciplinary assessment happens iteratively, and the components provided by the various disciplines are iteratively integrated to produce new, emergent forms of systems knowledge, target knowledge (goal setting in order to better deal with problems), and transformation knowledge (by investigating how existing practices can be changed) (Wiesmann et al. 2008). The merged outcome resembles "Mode 2" knowledge (Gibbons et al. 1994), which is socially distributed, application-oriented and transdisciplinary (Nowotny et al. 2003, 179).

In this merger the assumption is that professional knowledge develops according to the inputs from other participants. This new type of knowledge is not necessarily "derived from pre-existing disciplines" (Ibid., 186), but is instead generated within the context of application. Its creation requires unconstrained and instantaneous interaction, and is "highly reflexive" (Ibid., 187). It also requires iterative approach, such as "spiral dynamics" that emerge from details towards the holistic system level, and is emphasizing both professional side and the shared side of the process (Beck & Cowan 1996; as in Wahl & Baxter 2008, 76).

There probably are professional differences: stereotypically the “social scientist consults the natural scientist about *what* to implement and the natural scientist consults the social scientist about *how* to implement” (Pohl 2005, 1171). These disciplinary cores must be sustained to not lose “what the different parties actually care about in that system” (Hukkinen 2008, 45). Therefore, in parallel with the iterative co-creation of the design aim – on several scales and perspectives – there should be also a professional loop, in which the focus is on specialist and profession-specific tools.

Metadesigning collaborative frameworks

The integration of knowledge through an iterative process happens on the “metadesign” level that focuses on “conscious awareness, value systems, worldviews, and aspirations” (Wahl & Baxter 2008, 73). To further improve this type of blending, reflexive processes that build “value-consciousness” among researchers are required (Wiesmann et al. 2008, 438). Similarly, transdisciplinary design process is aiming also into higher contextual level: on mediation between value systems and visions, and on expanding stakeholder collaboration. Thus, it should also promote the merging of knowledge, value systems, problem-setting and goals.

There should exist a collaborative framework to design process, which would support such integration, and which would expand on solution level from details to the whole, and on value level from the whole towards the details. While the emphasis for multi-professional collaboration has to be on the professional skills and expertise, in sustainable design the complex problems always also require a transdisciplinary approach. This calls for a problem assessment process that is done iteratively, integrally and within a shared problem space, but with the predefined disciplinary competences.

Material and Methods

This paper looks into how students in design, architecture, engineering, real estate and economics approach the concept of sustainability and the collaborative design process, and explores the differences between disciplinary approaches and understanding. Data is gathered with questionnaires from students of a new multidisciplinary Masters' programme in Aalto University called Creative Sustainability (CS), which started recently in Fall 2010. CS master students have backgrounds in several professional fields, and the programme's curriculum has a strong emphasis on collaborative courses and real-life cases. During the academic year (2010-2011) these students attended introduction courses that aimed to prepare them for multi-professional collaboration (5 ECTS), and then to complete modules (up to 15 ECTS), which were engaging several professions and involved the students in multidisciplinary teams with specific design cases. As such, these students represent a good sample group to study transdisciplinary knowledge building.

Research data

The research data is gathered with questionnaires from students of two study-modules in CS programme, of which the other was organized in Fall 2010 by the Department of Design (14 answers), and the other during Spring 2011 by the Department of Architecture (14 answers). Courses had students

with backgrounds in various design fields, such as industrial (7), product (2), spatial (2) and graphic design (2), engineering (2), architecture (6), real estate (2), economics (2) and media communication (1; two students participated to both courses). Both courses were credited with 15 ECTS, and they included a series of lectures and a design case to work with.

Student questionnaire

The student questionnaire was created on the basis of the findings in the literature study, and on the earlier research. The part of the questionnaire, which is in focus in this article, consisted of triangular matrixes, rating the balancing between the dimensions of sustainability, and the emphases in multi-professional collaboration (see Fig. 2).

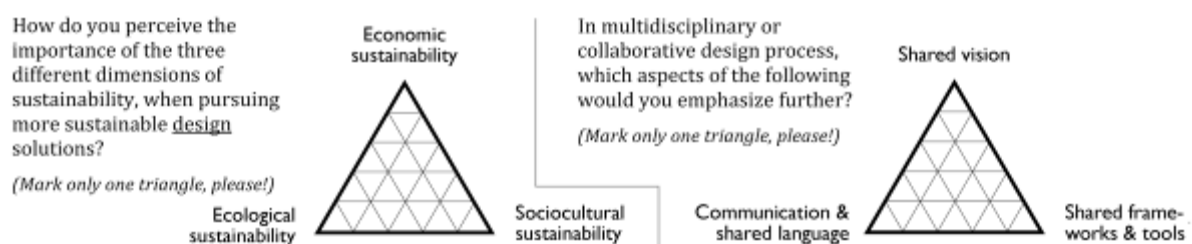


Figure 2. The student questionnaire and the triangles.

The results are assessed to visually compare where the emphases are, and how shattered the outcome is. These findings are then reflected on the earlier findings from the theory and literature. Aim in the analysis is on understanding what drives certain approaches and emphases in the transdisciplinary design collaboration for sustainability.

Findings from the data

According to the findings from the literature, the three-dimensional approach to sustainability might not produce an "integrated" outcome (Gidding et al. 2002, 194). Instead, the design process should assess the dimensions hierarchially, or at least be aware of the possible professional accents. Furthermore, the transdisciplinary collaboration should be based on integrated value systems and new application-oriented knowledge. Hence, it seems that at least fluent communication, and perhaps even a shared aim should be promoted. Against the previous research it is justified to assume that in sustainable design in general shared understanding of the problem should be perceived beneficial. This, however, requires certain experience, skills and management from the team, and a correct framework provided by the teachers or managers.

This section describes the results of the questionnaire in relation to the theory in the background. The results are divided firstly according to the students' professional backgrounds either in design (industrial, product or spatial) or then architecture, engineering and real estate, and then secondly according to the two different study-modules, either by the Department of Design (10 students from

design fields, 2 from economics and 2 from engineering) or then by the Department of Architecture (6 from architecture, 2 from real estate, 2 from engineering and 4 from design fields). The aim is to identify the emphases and their relations that grow from the professional background or the particular context of the design focus of the study-module.

Professional differences

In the images below, the questionnaire material is divided into two groups according to the educational backgrounds of the students. The first group (see Fig. 3, left side) consists of the students with backgrounds in industrial, product or spatial design (11), and the second group (see Fig. 3, right side) of the students from architecture, engineering and real estate (12). The amounts of student answers are visible in the sub-triangles.

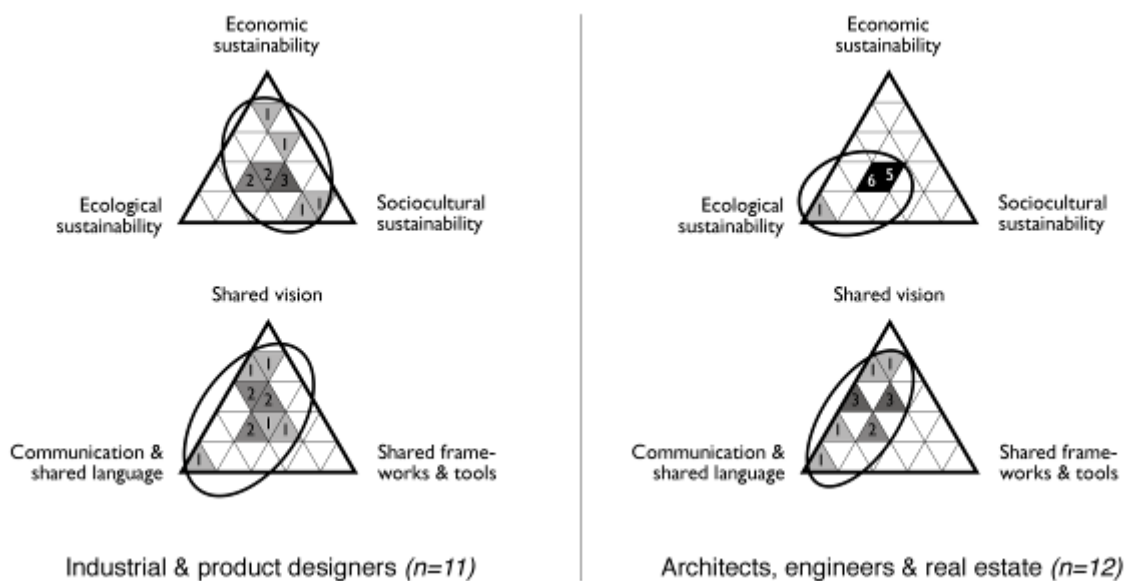


Figure 3. Results divided by the students' professional backgrounds.

Both of the groups seem to stress "shared vision" and "communication and shared language" over "shared frameworks" and "tools", and this fits well into the findings from the literature. However, there seem to be some differences in how the participants in the two groups balance the different dimensions of sustainability in their approach.

According to the literature review there are different types of professional approaches to sustainability, and the findings from the data seem to support this assumption. The designers in the first group – perhaps being more socially or humanistically oriented – seem to emphasize the "sociocultural" side more than the second group. However, they also seem to stress the "economic" dimension more than the latter group.

Differences in the educational approaches

It seems also that not only the professional background, but also the context of the particular course is orienting the focus in collaboration. If the results are divided by the two study-modules (see Fig. 4), it seems evident that actually the courses are orienting the focus of the collaborators. Although the first course (SPD) consisted mainly of designers, the latter course (SUD) consisted of a greater variety of participants (6 from, 4 from design fields etc.) and still resulted in more precise focus in the answers. The difference in the students' answers seems to be mostly linked to the course itself and to its educational approach, and not that strongly to the background of the participants.

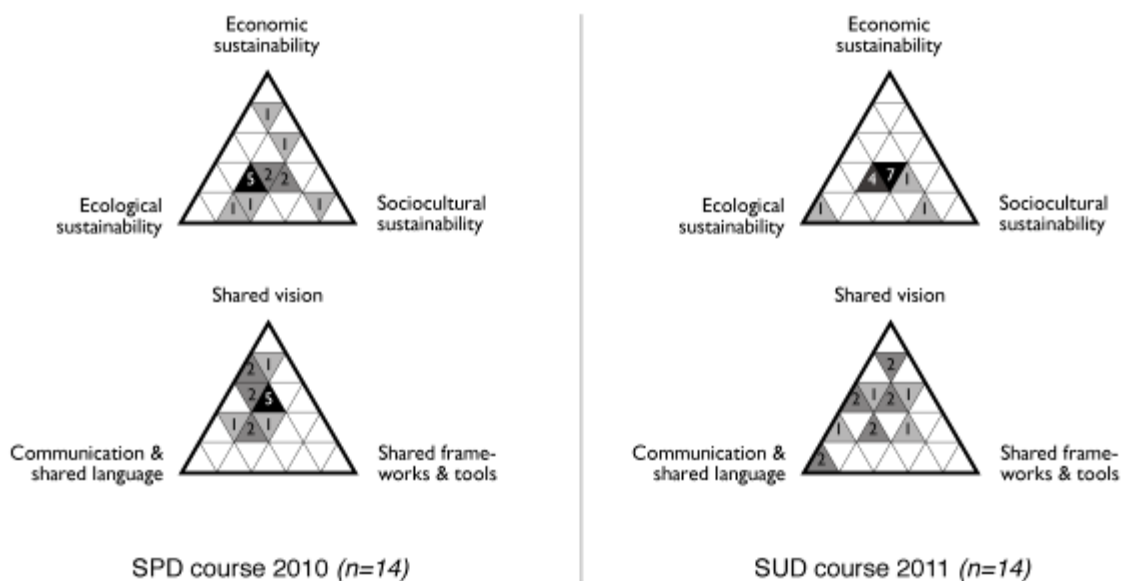


Figure 4. Results divided by the two study-modules.

In general, it seems that the architectural education might emphasize ecology over sociocultural wellbeing, and this might be well justified since the aim in that profession is usually on very large scales. And design vice versa, as product and service design practices seem to focus more to human level, where the focus extends more clearly to the sociocultural and even the economic aspects.

3. Discussion: Collaborative frameworks for sustainable design

The findings from this questionnaire suggest that in transdisciplinary collaboration the focus should be put on the design aim and its negotiation, instead of the professional approaches of the participants. In multi-professional education, this can often be defined by the educators themselves and the iterative process can be linked to chosen course works and cases. As managers of collaborative work these educators should carefully define, at least to themselves, what *kind* of sustainability is taught in their courses. Although the earlier research on this topic shows several different approaches by the collaborators themselves - and these obviously exist - more important is how the design challenge is laid

out. While there are some necessary skills for collaboration, it seems that the focus should be brought specifically on communication, and on the iterativity and reflexivity of the process.

Design abilities to orientate towards sustainability

According to literature, design skills can help to change "worldviews and value systems" (Wahl & Baxter 2008, 83). In the transdisciplinary collaboration this ability should not be perceived as something that is tied to the profession or discipline, but instead as a skill that can be learned despite the professional background. The collaboration should be built so that it allows the scaling of professional knowledge, but also the metadesign of value systems for the task.

Transdisciplinary design process requires collaborative and synthetic skills (e.g. defining, reflecting, contrasting, synthesizing). It also requires general, shared frameworks (e.g. 'spiral dynamics', integral vision) and specific, disciplinary frameworks (e.g. natural vs. social scientist). And finally, it requires general tools to facilitate collaboration (e.g. SWOT, Mind Maps) and specific, professional tools (e.g. LCA, Return On Investment, etc.).

The findings from the literature and the data suggest that it is needed to put the personal, psychological and even the professional pre-assumptions aside, and instead focus on the aim of the work, and more specifically on the level of sustainability that the chosen aims are in. Designers, engineers, architects and all the other professions that take part in transdisciplinary collaboration should be willing to continuously negotiate the aim of their work, to reshape their understanding of the problem, and to "evaluate whether [they]'re truly working on a solution at the right level to make the change intended" (Shedroff 2009, 8).

Disciplinary competences

There probably are professional differences in approaching sustainability, but it seems that these differences can also be reoriented with a proper facilitation of the collaboration. This suggests that the collaborative design process can be oriented towards specific system dimensions, not necessarily according to professional backgrounds, but in link with facilitation, case, background material and sub-tasks. While the disciplinary approaches towards a design process may vary, these approaches are not dictated by the participant's personal characteristics, but are instead learned through experience in earlier projects and work.

In education, there is a need to guide collaborative design towards specific dimensions of sustainability, according to the educational focus. The emerging transdisciplinary knowledge of application, "however widely distributed, however trans-disciplinary, however heterogeneous, however reflexive" must be "managed" (Nowotny et al. 2003, 189). Still, to enable truly integrated outcomes, some leeway should be left for the student teams to be able to reshape their knowledge and approach to the design task.

4. Conclusions

Social concerns are issues for sustainable designers (Shedroff 2009, 15), as well as ecological concerns for sustainable architects. But these concerns should intertwine even more. A transdisciplinary framework for collaboration should not aim into forcing one single approach to all the participants. Instead, it should be based on the co-creation of the value systems and design aims. This process requires a good facilitator that is able to balance the shared and professional processes – and also the professional differences – into a negotiated, shared outcome.

Rather than believing that we could design "universally applicable blueprints" (Wahl & Baxter 2008, 73) or "perfect solutions" for "more sustainable offerings" (Shedroff 2009, 20), the aim should be put in reshaping the collaborative framework and process. It may prove to be more useful to seek these sustainable outcomes as "an emergent property of the complex dynamic system in which we all participate" (Wahl & Baxter 2008, 73). A framework that promotes the use of disciplinary competences and is at the same time based on an iterative dialogue would create a proper platform for transdisciplinary collaboration, in which the participants would be able to analyze, translate and scale their professional knowledge and experience, as well as others.

The managers, however, should bear in mind that not only the participating disciplines, but also the design focus is dictating the outcomes. Also the educators can orientate the transdisciplinary design process by selecting the necessary professional and psychological approaches, choice of tools, team set-ups and certain exercises, to be able to foster the necessary level to aim with the particular professional expertise. In the integration of knowledge the focus should not in the end be "on types of people" but instead on "types in people" (Wilber 2001: 6). In multi-professional collaboration it's not that much about the participating professions and not about the people themselves, but about the proper framework for collaboration and the application of the work so that it supports integrative approach.

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6. SUSTAINABLE ECONOMY

INNOVATIVE FISCAL POLICY IN THE CONTEXT OF SUSTAINABILITY

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1. Introduction

Recent economic history pointed out that modern society has been contributing to the crescendo deterioration of the natural environment embracing climate safety and urbanisation problems as well as the gradual decay of biodiversity (MEA, 2005). It is hardly by chance that the issue of sustainability has been incrementally naturalized in the *economics of sustainability* by using the building blocks of ecological, environmental as well as of resource economics. The concept of sustainability encapsulates the sustainability as an ethical-based, integrated and interdisciplinary approach with the view of guaranteeing the fundamental needs of the current generation without endangering the ecological system or the chances of future generations.

One of the major conclusions that can be drawn from the achievements of behavioural economics is that the human nature requires sustainability. Kahneman and Tversky (1979) pinpointed that people are more sensitive to losses and pains than to foregone gains. *As a consequence, the aspiration for minimizing losses can be ranked to the basic needs of human nature, and its most expedient way is the establishment of sustainable systems.* If we take into consideration that numerous environmental problems can be seen as manifestation of cumulative effect of private contributions, we can get to the conclusion that of the behavioural and social sciences interpreting this phenomenon as the so-called *common pool resource* problem alluding to the fact that societies/individuals are competing with each other for natural resources. *The negative environmental effects as a collective outcome of complex set of behaviours can only be dampened through strong and consistent incentives/rules aiming at modifying the behaviour.* Let us add that credible rules are needed when there is no time to wait until the evolutionary development of preferences because it would entail too many costs.¹ Additionally, rules are credible only if people are completely aware of the fact that the consequences of being without them would be much worse. Nonetheless, having too strict rules likely hampers the necessary correction and learning processes. The state should therefore actively underpin its role for being an *informant on sustainability* during the sequential behaviour-modification.

¹ This is the case when it comes to the sovereign indebtedness from the side of fiscal sustainability; indebtedness will not be winded up without interventions, i.e. implemented fiscal consolidation and/or stipulated fiscal rules, established independent fiscal institutions in favour of prevention.

Our article addresses the question of what kind of fiscal policy could properly contribute to the requirements of fiscal sustainability which is a major constituent of the sustainable development, as well. After outlining the economic justification of fiscal sustainability we intend to conceptualise the innovative fiscal policy complementing it with a short review of Finland. The Finnish case may offer empirical support, and at the same time, its example gives us an opportunity to refine our argument on the institutional conditions required by fiscal sustainability.

2. The economic justification of fiscal sustainability

One of the research directions of *economics of sustainability* is inclined to address the question of what kind of institutional, political and governmental mixture is able to serve the objectives of sustainability. The relevance of this research area is originated in the theory of sustainable development which also implies the sustainability of the whole economy in which the dimension of fiscal sustainability is of great importance. Therefore maintaining a sustainable fiscal policy can be treated as a movement towards the *governance for sustainable development*.

We can claim by no means that any increase in debt level is totally harmful for the economic development, because each debt item is ultimately a capital resource, thus the real question is what the deficit has been spent on. While exploring what public debt level seems to be unsustainable is a complex set of issues, fiscal policy can be regarded as sustainable when maintaining its current condition – without any considerable revenue or expenditure side correction – ensures the state's solvency in the future as well. The *conditio sine qua non* of this is the strict definition of a fix debt/GDP ratio, and the rate of economic growth should be at least as high as the real interest rate paid on debt. *Accordingly, the real emerging burden of public debts is the interest payment, which might have a strongly negative impact on the potential growth of an economy.* The eclipse of real interest payment could entail debt reduction due to the positive primary balance (Afonso – Hauptmeier, 2009). Albeit the permanent and substantial structural deficit could not be outgrown without any treatment, thus it is able to cause serious damages in the life of the current generation. Moreover, it may also exacerbate the life of the next generation through the crowding-out effect. Governments have to set a target of such an optimal level of debt, which guarantees sustainability in a longer time horizon, and as such, also provides a highly safe way of repayments even in time of serious economic and social shocks (e.g. demographic challenges). In developing countries, this level of debt is around the average debt rate of advanced economies, but the past records of repayments ought to be treated as a determinative factor (Reinhart et al. 2003). Besides the future consequences of indebtedness, it also has immediate negative effects (slack economic growth, increasing inflation, higher debt service, rising likelihood of potential debt crisis).

Having a balanced fiscal policy also means that public finance does not endanger the intergenerational solidarity in the concept of sustainable development, furthermore, sustainable fiscal policy serves as a buttress to develop and utilise human capabilities by grounding solid financial background. Fiscal sustainability also implies higher flexibility of public finance and significantly improved efficiency of automatic stabilisers and *a fortiori* healthier capability to adaptive strategic planning.

3. A concept of innovative fiscal policy within the sustainability framework

We argue that fiscal sustainability is one of the most crucial prerequisites for the broadly defined sustainability, and what is more we underline the importance of innovative fiscal policy, i.e. the implementation of intelligent and holistic fiscal policy in order to furnish the long term sustainability of public finance.

More precisely, defining a rule about the quasi maintainable fix debt-to-GDP ratio – or deficit level – by relying mostly on the contemporary situations does not seem to be sufficient. Rather efficient would be such a planning whose dynamic view pervades both the revenue and expenditure sides by envisaging future challenges, especially higher level social, environmental and economic objectives. This establishes a claim for a fiscal policy which is able to intelligently manoeuvre, to provide the necessary fiscal latitude and to assure much more realistic expectations via more credible fiscal practice. By intelligent manoeuvring we mean that fiscal policy *is able to recognise* – due to the permanent monitoring of the budget – those worthwhile fields which are more likely to have stronger positive outcome in the future if the government put them into the focus compared to other fields. Accordingly, fiscal policy aspires *to intelligently allocate and/or combine* between revenues and expenditures through its discretionary ability within the framework of targeted deficit and debt levels. This also assumes that the fiscal policy has a *holistic character* as well, i.e. it has an integrated approach embracing both the environmental and societal dimensions. This type of fiscal policy behaviour can be regarded as *innovative*.

The economics of sustainability implicitly requires two characters from the aforementioned innovative fiscal policy. On the one hand, there is obviously need for a “*sustaining*” character so that the fiscal policy could continuously guarantee the sustainability of sub-systems through intelligent allocations and/or combinations without leaving the decisive structure of public finance. On the other hand, long term sustainability postulates such a fiscal policy which is adaptive to the epochal environmental, societal and economic changes even if it has to entail radical structural transformations. The latter can be seen as a “*disruptive*” character of innovative fiscal policy whereby the public finance is profoundly getting in alignment with the changed market structure.¹ Apparently, the intellectual stream of the broadly defined sustainability demands more emphatically the disruptive character of fiscal policy. It is rather important because the core internal presumption of sustainability is the system’s ability to properly modify its operation according to the environmental changes and constraints, in which the role of innovative fiscal policy is undisputedly high.

The concept of innovative fiscal policy also ascribes large significance to the human nature – such as its present bias either in the level of social behaviour or in the level of political measures – behind the

¹ The sustaining and disruptive model of innovation was described by Christensen (1997) who emphasised that the sustaining innovation aims at maintaining the well functioning structures, the latter one in turn assumes a more radical innovation which leaves the main features of existing structure behind and establishes an outcome with much better adaptation to the changed circumstances. Christensen (1997) demonstrated such radical innovation in the info-communication industry; accordingly, the technological development has a crucial role. For example, one can think of such fiscal policy changes potentially induced by technological revolutions documented by Perez (2002). After the rise of a new techno-economic paradigm – replacing the era of mass production – the state role became much more stressed especially from the side of fiscal policy in support of R&D and innovation.

development of indebtedness. The currently increasing deficit and debt in proportion of GDP is not more than a choice of a basket containing short term pleasure and long term pain. The mitigation of indebtedness and the achievement of fiscal sustainability are mainly relying on fiscal consolidations and institutional reforms. Having the dominant view that the *planned fiscal adjustment and reform will provide opportunity for compensation – rather than inducing losses, merely – for the current sacrifices is particularly strongly conducive to fiscal sustainability.*

From the point of view of traditional economics, human being is rational; therefore decisions are made in support of self-interest and of maximising the personal utility. Rationality also holds at the level of fiscal policy decision making, when, as the public choice theory demonstrates, policymakers tend to follow their personal interest via attempting to obtain as abundant budget resources as possible in order to maximise their self-interests without circumspectly internalising the cost-related consequences of this behaviour (Alesina – Perotti, 1996). Thus they are to a high degree assisting to the eventually suboptimal budgetary policy. Myriads of studies have shed light on the limited rationality of voters, but this is also true in the case of fiscal policymakers. Perhaps even more importantly, there is uncertainty over to what extent the voters are able to comprehensively understand the non-linear processes, thus they can be manipulated with regard to the real fiscal landscape (Buchanan et al. 1986). As a result of this uncertainty, the significant and necessary changes can easily be stymied.

From the perspective of the current analysis, the fiscal adjustment can be seen as *experience goods*, i.e. voters judge the adjustment on its repercussion. And presumably, fiscal consolidations can also be ranked into the group of *credence goods*. It is hardly by chance that successful fiscal adjustments occur more frequently in high-trust environment. There is a high degree of confidence in the broad conclusions of fiscal adjustment-related studies that the fiscal consolidations and institutional reforms will induce long term beneficial impact. However, there is need for time even if the consolidation can be viewed as a Kaldor-Hicksian adjustment. We argue that this type of adjustment has short term non-Keynesian effect, i.e. short term expansionary effect, which gives an *opportunity* for the government to compensate the losses induced by the adjustment.¹ Since experiencing and judging the effects of a fiscal adjustment always demand time, fiscal adjustment imperatively poses uncertainties for the voters about the fiscal outlooks due to the limited rationality as indicated earlier. Subsequently, fiscal consolidation requires social capital (e.g. trust) whereby the necessary positive expectations could emerge. The short term expansionary effect serves as a trust builder- and maintainer channel by constituting a vital element of the innovative fiscal policy. Let us add immediately that each European fiscal consolidation can be regarded as a unique phenomenon, and therefore it is particularly difficult to get the standard and optimal rule of the expansionary fiscal consolidation. There is a massive identification problem due to the complexity of impacts. Firstly, fiscal institutions exert influence on fiscal outcomes and *vice versa*. Secondly, the evolution of fiscal institutions also has effects on various factors which also influence the fiscal outcomes. The empirical evidence suggests that the government has to be genuinely committed to an expenditure-side consolidation, which focuses primarily on the public sector wages/salaries,

¹ An economic decision (e.g. fiscal adjustment) can be viewed as Kaldor-Hicks efficient when the winners have the opportunity to compensate the losers (Kaldor 1939; Hicks, 1939). Many authors judged the successfulness of an adjustment on the basis on changes in deficit and debt-to-GDP ratio as well as in cyclically adjusted primary balance. See: Alesina and Ardagna (1998). Our approach encompasses the growth dimension as well.

transfers, and social contributions in accordance with the suggestions of empirical results. The persistent and significant consolidation should be constituted under the consideration of the initial conditions. Further core factors of the potentially arising expansionary effect are the institutionalization of fiscal policy (i.e. the establishment of the rules-based fiscal framework), the structural reforms and the optimistic expectations of the private sector on future incomes, as well.

Easily reasonable that the innovative fiscal policy ought not to neglect the *institutional settings* either. As soon as a country reached the fiscal sustainability, when the question of to what extent of flexibility would be needed for fiscal policy arises. This question is not irrelevant because the ageing population, the depletion of natural resources *per se* call on more adaptive fiscal policy. *Institutions invoked to serve the sustainable fiscal policy should be developed in terms of such values which are completely in accordance with the social and environmental conditions of the given economy.*

In an effort to meet the requirement of sustainability regarding the aspiration to loss-minimizing, the fiscal policy should resort to institutionalisations that dampen the risk of indebtedness even further. Hereby the ultimate objectives are on the one hand to capture the recognitions of political economics¹, on the other hand, to promote the acclimatisation of long term view spanning over government cycles, to foster the credibility and last but not least the trust building. The latter one can be facilitated not only by the introduction of rules-based fiscal policy (numerical fiscal rules and/or procedural rules) but also by politically independent and unbiased fiscal institutions (agencies, councils) complementing the rules that can often be extremely strict or lax. The mixture of rules and independent institutions can stimulate the necessary flexibility, which is required for greater discretionary function, and fiscal transparency, as well.² Nevertheless, since the deficit and debt levels can be regarded as social value orientations within a democratic framework, policymakers should refrain from giving extended authority to the independent fiscal institutions (e.g. giving political and legal responsibility, as well). Accordingly, these independent institutions should be rather consulting than decision making bodies bearing also the opportunity to address how existing fiscal rules relate to “higher level” social and economic objectives.

We argue that innovative fiscal policy should represent a fiscal responsibility framework which includes both the fiscal rules and the independent fiscal institutions. If for no other reason than because the innovative fiscal policy always requires capacity to intervene discretionary, especially in time of (global) shocks, in the favour of good fiscal performance. According to Kopits (2004), fiscal rules should cover the whole public sector with the stipulated requirement of surpluses in the structural balance. In addition, politically independent and unbiased fiscal institutions should be set up to credibly represent a more disciplinarian fiscal policy. Since independent fiscal bodies are often responsible for monitoring the long term sustainability of public finance, they stand sentinel to provide analyses with due diligence on short term fiscal latitude, thus it enhances the *informant role of the state on sustainability by offering better transparency.*

¹ Numerous political economics studies shed light on the short-term bias arising in case of parties during the electoral competition, which is more likely to lead to Pareto-inferior states and political budgetary cycles. One of the most pertinent insights on this topic was written by Nordhaus (1975).

² National fiscal institutions are independent bodies (e.g. councils), other than the central bank, tax office, government or parliament, that prepare macroeconomic forecasts for the budget, monitor fiscal performance and/or advise the government on fiscal policy issues. Fiscal rules bring rigidity into the system and thus restrict the opportunities of distributional coalitions, whilst the independent fiscal body is to bring the necessary flexibility into the system at the same time.

4. Fiscal sustainability in the European Union - a shattered dream?

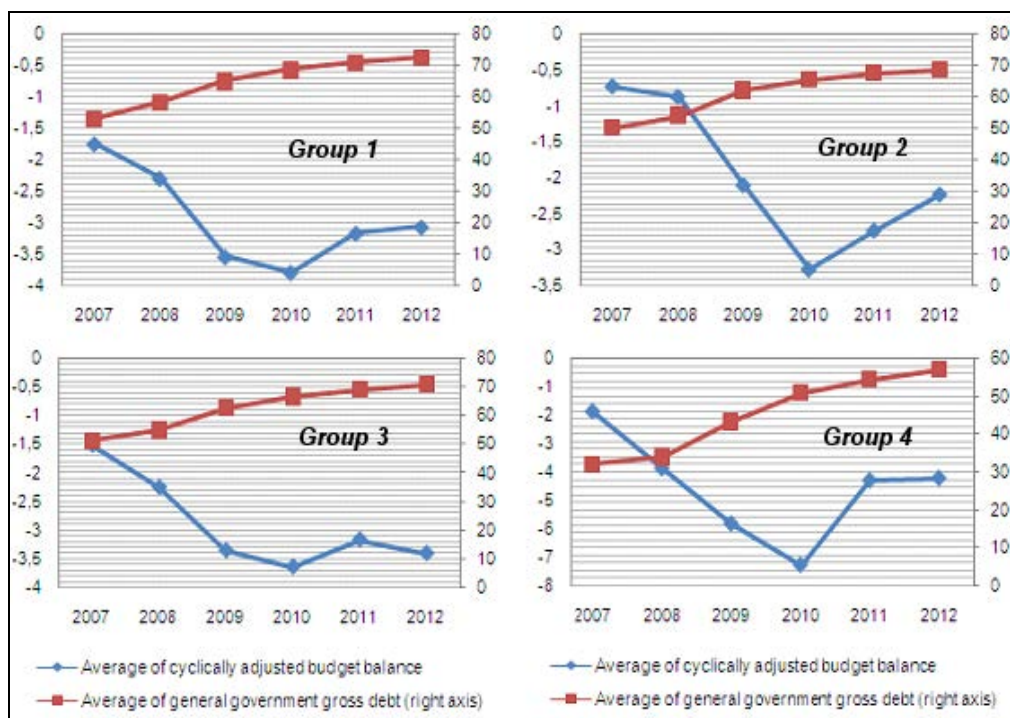
By now, the fact that the deficits – and ultimately debt-to-GDP ratios – have been permanently rising in most developed countries since the 1970s goes into commonplace. Moreover, the financial crisis erupted in 2007 shed light on the great importance of the requirements for more disciplinarian fiscal policy. Recent trends of fiscal performances in the developed world suggest that the era of great moderation – when the cyclical fluctuations showed significant dampening – and thus the complacency regarding the exposure to fiscal challenges have ended. More and more European countries faced serious liquidity problem (e.g. Hungary, Latvia and Romania in 2008) and even the threats of sovereign debt crisis (Italy, Spain, Ireland, Greece and Portugal in 2010). Importantly, Reinhart and Rogoff (2011:4) already considers the period 2007-2018 as a decade of debt.

As a corollary, the question of fiscal institutions tailored towards fiscal sustainability is still relevant in the European Union where the Stability and Growth Pact has not been able to promote fiscal discipline throughout the Member States. The inefficiency of the Stability and Growth Pact (SGP) was manifested already in its lenient manner concerning the sanctions on non-complying countries such as Germany and France. Still, aiming at strengthening the SGP suffers from the lack of empirical evidence collected by many conveying the message that the internal fiscal commitment is more likely to be effective than the external anchoring role of the EU. It seems that SGP with an extended authority (e.g. with explicit debt rule) would have a deleterious effect on the democratic system if it wants to directly influence the given taxation and spending constellation of a country. Under this angle, the strengthened SGP will surely pose problems with regard to the transfer of sovereignty of nations. As a consequence, another way to improve the national fiscal policy is the fiscal institutionalisation at national level. Independent fiscal bodies, as complements of fiscal rules, are more likely to help the more sufficient transfer of sovereignty by providing flexibility for countries how they want to impose tax and spend on different fields under the consideration of prudent and sustainable debt management (Wyplosz, 2010).

While lots of countries have introduced such institutions by nowadays, we can make a distinction among them according to the authorities and tasks they have. Therefore we rank the countries using fiscal councils into 4 groups in order to decipher the councils' potential contribution to the improving fiscal discipline by the end of 2000s: *Group 1* where the fiscal council's tasks imply the preparation of binding macro forecasts for budget; *Group 2* where the councils are preparing nonbinding macro forecasts for the state budget; and *Group 3* where the council is responsible for monitoring the budget performance. In an effort to have a more comprehensive picture on the performance of countries establishing councils we also contemplate *Group 4* countries being without such fiscal institutions.¹ Chart 1 suggests that *Group 4* countries seem to be in much worse fiscal conditions both in terms of the trajectory of cyclically adjusted budget balance and general government gross debt ratio.

¹ Group 1: Austria, Belgium, The Netherlands and Slovenia. Group 2: Denmark, Germany, France, Italy, Luxembourg, Sweden and United Kingdom. Group 3: Belgium, Denmark, Germany, Estonia, France, Italy, Lithuania, The Netherlands, Portugal and Sweden. Group 4: Bulgaria, Cyprus, Czech Republic, Finland, Ireland, Latvia, Malta, Poland, Romania, Slovakia.

Although Finland can be ranked into *Group 4*, its fiscal performance was by far the best even among *Group 1-2-3* countries not only in the period displayed above, but also in the last two decades.¹ This is *per se* puzzling especially if we take into account that the predominant part of empirical analyses emphasised that the rules and institutions are positively affecting the development of public finance (Debrun et al. 2008). Accordingly, the mixture of rules and independent bodies may not serve as a prescription in each case and in every economic situation.



Source. Data and estimations for the period 2010-2012 are provided by the European Commission (2010).

The Finnish case suggests that there must be exceptional cases where countries reached fiscal discipline without using any legislated fiscal rules and institutions at the same time. *A contrario*, there must also be such cases where the rules and institutions did not prove to be as efficient as one would have expected.² This *per se* calls on economists to always devote attention to the local context of the given country in assessing its fiscal performance or the impacts of an institutionalisation. To this end, we shortly review the case of Finland by concentrating on its fiscal performance with special attention to the crisis experienced in the early 1990s. The Finnish case may provide, to a certain extent, ammunition to our concept about innovative fiscal policy and help to address the question of when the mixture of rules and independent fiscal institutions could be effective or necessary, as well.

¹ The debt-to-GDP ratio was 42.8% on average in the period 2000-2011; moreover, the cyclically adjusted total revenues were higher than that of the expenditures by almost 2 percentage points on average; the centralisation as well as the unemployment rate have dampened over the period and the real GDP growth hovered around 3.5% on average. Despite the recent financial crisis, only 2009 can be considered as a year of recession, merely.

² For example, Portugal has an independent fiscal institution; however, the Portuguese fiscal policy has been unable to conduct disciplinarian fiscal policy in the last two decades. Furthermore, the recent financial and economic crisis casts shadow on the prospects of its public finance as well.

5. The case of Finland - crisis and revival

Finland's crisis anatomy can be broken into three phases having significantly different characteristics: (i) the era of the financial liberalisation and the economic boom within the period 1985-1990, which culminated in an overheated economic situation; (ii) the second phase (1990-1993) was dominated by the financial crisis and its infiltration into various industries which was accompanied by the implosion of the Soviet Union worsening further the economic potential; (iii) third one was the phase of recovery which was pervaded by intelligent fiscal policy practice covering the period 1993-2000. The recovery period may have important messages for fiscal sustainability and fiscal consolidation-related theoretical and empirical literature therefore we tend the focus on that particular phase.

Finland seems to be inconsistent with the conventional wisdom of new political economy – namely, that a coalition government reacts to a fiscal shock with hysteresis leading to much worse fiscal performance due to the distributional conflicts that occur among coalition parties when they want to decide whose voters should bear the brunt of the burden of the consolidation. Moreover, the Finnish case does not fit to the experience of past decades on the evolution and use of fiscal rules and independent fiscal institutions, either.

Overheating was to a large extent a result of the financial deregulation leading to the escalation of credit lending, which *inter alia* was unfolded in the rising asset prices, in the permanent and intensified increase in consumption, investment as well as in capital inflow. These straightforwardly led to an impaired international competitiveness and to speculative attacks against the fixed exchange rate. The pre-crisis period showed financial vulnerability as it was demonstrated by the soaring deficit level and debt-to-GDP ratio.

Processes assisting each other created a *descending negative spiral* determining a significant increase in unemployment which was mainly given by the substantial jump of real interest rates, the deflation of asset prices and the immature character of financial system as well as the uncontrollability of deficit and debt-to-GDP ratio. The recovery period exemplified that a coalition government – contrary to the conventional message of new political economy – can be able to intervene in time if it recognises areas that are more likely to have positive effect on the economy due to more dedicated fiscal concentration without endangering the social trust. Subsequently, the negative spiral can be converted into *self-sustaining virtuous circle*, and fiscal sustainability can be a real perspective.

Without forgetting the fact that the comprehensive structural reform had a pivotal role behind the recovery, we emphasise that the crisis disclosed such suboptimal economic policies which were sheltered by business cycles in time of peace. In this regard, the *capability of government* to correct or select out those policies, maybe to incorporate new priority, was potentially one of the crucial elements in the recovery.

The discretionary measures, such as tax raises and spending cuts implemented in the first half of 1990s – dominated by tall interest rates¹ –, did not lead to perceivable consolidation, still. Spending cuts did not have spectacular and extenuating effects on deficits due to the general consequences of tax raises

¹ Since the German reunification led to soaring deficits and inflation, Bundesbank rose the interest rates whereby the European rates also showed an upwards trend up to 1992.

which induced lower tax revenues – because of the demand shrinkage and the increased unemployment rate – making unable the government to safely finance the expenditures which persistently outreached the expected volumes. *Nonetheless, the emergence of the decrease in interest rate appreciated the value of formerly started measures aiming at limiting the expenditures leading to improved fiscal latitude, and at the same time, revenues exceeded their expected volumes.*

The international climate, characterised by moderating interest rates, did not threaten the occurrence of such precisely coordinated fiscal policy which could be circumscribed by restrictive and also expansive features.¹ One of the major antecedents of the coordinated expansionary mechanism was the crisis which shed light on those policies that proved to be unsustainable. Coalition government intended to correct them, and what is more, it put R&D and innovation into the focal point, thus that intensified fiscal concentration brought anti-cyclical feature into the expenditure structure of the Finnish fiscal policy.² This kind of governmental strategy accelerated the transformation of the Finnish society to be a knowledge-based information society (Benner, 2003). The fiscal consolidation, started in the first half of the respected decade, went through a significant *character change* and thus the coalition governmental efforts were crowned by success. The consolidation became predominantly expenditure-sided. As a corollary, the deficit was converted into surplus (1.3% and 7% of GDP in 1998 and 2000, respectively). Meanwhile, government was able to keep the proportion of revenues to GDP remarkably stable. And what is even more important, the level of revenues overcompensated that of the expenditures in the aftermath of 1997. As we indicated earlier, expenditure reductions *inter alia* were perceivable in the fields of education and health sector, as well. Since these sectors performed relatively well, they served as safeguards behind the reduction. Not to mention the fact that the financial basis of these sectors were considerably good (local governments were much better financial position than the central government was).

Actually, the new coalition government, came into power in the midst of 1990s, followed the line of consolidation initiated by former government. It can be emphasised with reasonable certainty because the deficit- and debt reduction, the significant rationalisation of expenditures as well as the improvement of international competitiveness were of key importance on the agenda of both coalition governments. The first coalition government came into power in 1991 was not inclined to resort to such strategic game which will eventually deteriorate the fiscal latitude of the subsequent „rainbow coalition” government. And what is more, the first coalition government of the 1990s was about to build up and maintain the trust level towards the state through austere behaviour. Almost 110 thousand public servant was dismissed between 1988 and 1998 (Fregert, 2009) – which offered helping hand for the following cabinet. And perhaps more importantly, governments always stressed that preserving the social market economy is a fundamental objective, which also nourished the trust level. Consequently,

¹ By coordination we mean that the coalition government heightened the expenditure level in case of fields that have long been already treated as priority such as innovation and R&D.

² Actually, the innovation policy can be regarded as anti-cyclical; however, it was reached via fiscal policy. R&D and innovation expenditures were incrementally increased in proportion of GDP (1993: 1.25% of GDP; 1996: 1.67% of GDP (Eurostat, 2010).

the *descending negative spiral* (vicious circle) was converted into a *virtuous circle* in which fiscal policy played a pivotal role.¹

The expenditure-side fiscal consolidation contributed to the emergence of virtuous circle at least from two sides. On one hand, with the coordinated use of created fiscal latitude the Finnish coalition government intended to foster R&D and innovation activities, and thus to trigger the enhancement of knowledge-based economy and the birth of a mature information society in parallel. It is also worth mentioning, that this discretionary governmental intervention implicitly relied mostly on broad social trust – which was traditionally the case in the field of science- and technology policy – towards both the coalition cabinet and state institutions. On the other hand, the sustainability of the welfare state's main features seemed to be guaranteed (Jonung et al., 2008). The information economy and the welfare state constituted together a virtuous circle at the same time. Due to the stabilised economic growth being far beyond the preliminary expectations, the government was able to finance the welfare services which – beside its social protection function – have been traditionally endowing the economy with skilled labour force as a prerequisite of further innovation and overall of the maturation of information economy.

In regards to the fiscal institutionalisation, being in close ties with the fiscal consolidation, it is one of the core constituents of the innovative and sustainable public finances. Finnish government succeeded in strengthening its role for being an *informant on sustainability* by improving the transparency. Public administration reform, announced in 1992, striven to stimulate transparency as well. The budgetary items were halved, which *per se* presumes that a sound state budgetary cadastre was to a certain extent established. Government intended to trigger the flexibility of the budget i.e. to increase the number of revenue and expenditure items that can be rapidly changed so that the discretionary power of fiscal policy improved substantially and the incremental character of the budgetary practice became outdated. The voluntarily introduced and naturalised, but not legislated, institution of expenditure ceiling also contributed to the transparency. It was also amplified by the direction towards medium planning in a more emphatic way emphasising the essential role of long lasting results since 1996. Albeit, such an independent fiscal institution which would make proposals or permanent analyses on the interaction between rules and targets complementing it with technical projections has not yet been established in Finland, still, fiscal policy was able to manoeuvre with not too strict rules without endangering the growth performance. It also assumes that Finland mainly had (and has) solid background for economic growth in terms of regulation, business environment, skilled labour force etc. One can conclude that the realistic targeting and the *ex post facto* investigations prepared by the State Audit Office and the Prime Minister's Office (Valtioneuvoston Kanslia) substituted well such fiscal institution. Nonetheless, one should also recognise that the direct impact of fiscal rules on economic growth cannot be unambiguously identified. What we can claim with reasonable certainty is that the use of fiscal rule facilitated the regeneration of fiscal discipline without being legislated from the onset. As for the reasons standing behind the success of the unlegislated fiscal rule – expenditure ceiling rule was voluntarily used by coalition governments – the theoretical and empirical literature gives us some insights. Kennedy and Robbins (2001) pointed out that the fiscal rules cannot be treated as

¹ It is also worth noting that the changing governmental practice in the science and technology policy – bringing much more market orientation into the system – had also a surpassing role in the process beyond the fiscal policy. See more: Pelkonen (2008).

panacea; furthermore, unlegislated fiscal rules can also be conducive to fiscal discipline. What is rather interesting in the Finnish success is the lack of independent fiscal institution. One can interpret the major findings of Schick (2003), Corbacho and Schwartz (2007) in case of Finland as follows, fiscal rules could perform well without establishment of further fiscal institution due to realistic deficit targets and the political commitment to fiscal discipline based on broad consensus as well as the efficient evaluation mechanism. And what is even more important is the fact that Finland's economic background provided a promising growth perspective through innovation by fending off the evaporation of social trust towards governmental institutions.¹

The consolidation was shortly followed by significant increase in the real GDP growth, still, deciphering whether what particular factors played key role in the emergence of non-Keynesian short-term expansionary effect is extremely difficult. Regarding the short-term recovery, we refrain from giving credit to such an argument that considers the short-term expansionary effect as direct repercussions of the implemented fiscal consolidation. Instead, we emphasise that this effect was indirect rather than a direct one and it was sparked by some anti-cyclical behaviour raising the level of specific items of expenditure. The expenditure-side fiscal adjustment served as an engine for the recuperation by providing ammunition for the national innovation and technology policy which tended its supportive focus on higher education, higher-level vocational training, R&D as well as on the renewal of industrial specifications. Insofar it can be ascertained that the Finnish coalition government intelligently recognised fields that are worth to be concentrated on. The Finnish fiscal policy born the stamp to a high degree of disruptivity, because its transformative power contributed to the industrial restructuring, as well, i.e. to leave the resource based economic paradigm behind. Naturally, this transformation was accompanied by the structural adaptation of the Finnish public finance to the new circumstances.

6. Concluding remarks

Although the mature discipline of sustainability economics cannot be clearly seen yet, it can be claimed that the need of sustainability can be originated in the human nature whose specific features call on the enhancement of the state's role for being an *informant of sustainability*. We argue that there is increasingly need for policies with longer perspectives. Innovative fiscal policy pervaded by holistic view should integrate the volatility of environmental, social as well as economic processes in order to have capabilities both to sustain (*sustaining character*) and to change (*disruptive character*) the structure in the long run. This implies that the innovative fiscal policy is neither pure pro-cyclical nor anti-cyclical. Existing beside each other is a core constituent of innovative fiscal policy. Beyond trust and positive expectations – which are to a large extent influencing the emergence of Kaldor-Hicksian expansionary

¹ According to Kornai (2010), the major prerequisites of an impulsive innovation process in capitalism are the following: decentralised initiation; high rewards; competition; opportunity for wide experiments and flexibility of financing. Decentralised initiation means that every business actor (e.g. SMEs) can determine themselves what they want to invest in. Ultimately, the most successful innovations are accompanied by an enormous amount of financial reward including long-lasting reputation. The success of the innovation relies to a large extent on the available financial resources and the absorption capacity of the society. While the financial flexibility was provided by the consolidation, the latter offered a wide arena for extensive experimenting, which was to a large degree the case in Nokia's success in Finland.

fiscal consolidation –, the above mentioned are essential for holistically designed and intelligently focused fiscal policy to have better opportunity to *allocate and/or combine* between revenues and expenditures through its discretionary ability within the framework of targeted deficit and debt levels. The mixture of fiscal rules and independent fiscal institutions – as trust builder and maintainer channels – seems to support the discretionary ability if they are *introduced on consensual basis* therefore it appears to be in line with the economics of sustainability.

Example of Finland was used in order to lend support to the conceptual findings of innovative fiscal policy within the framework of sustainable public finance. As Finland demonstrated, the transformative power of fiscal policy can be mainly originated in its innovativeness. The ability of coalition governments to continue the already started consolidation efforts without significant hysteresis – being diametrical opposition to the conventional wisdom of new political economics – was the *conditio sine qua non* of the Finnish success. It also exemplified that innovative fiscal policy assumes that the *commitment to fiscal discipline has to be autochthon*. With substantial focus on the evolutionarily developed and mature fields by *preserving the social market economy*, government was able to enjoy the necessary broad social trust. Coalition government carried out a concentrated adjustment whereby it pursued the consolidation results achieved by former government, so the focus on R&D and innovation fields having adequate framework conditions became much more intensified. Pro- and anti-cyclical fiscal policy were in tandem and thus provided financial resources primarily through perceptible reduction in public sector wages, transfers as well as social expenditures.

Additional resources streaming towards the above mentioned fields had a catalysing impact on economic growth, thus the consolidation can be portrayed as Kaldor-Hicksian expansionary adjustment which offered opportunity for indirect compensation contrary to the conventional considerations on expenditure side fiscal adjustments calling the attention to the recessionary effect of the expenditure based interventions. Disengaged financial resources were allocated towards such fields that were more likely to facilitate the recovery and the road to the knowledge-based economy.

After contemplating the Finnish case, we can refine our argument about the use and necessity of the mixture of fiscal rules and independent institutions in favour of fiscal sustainability. The mixture seems to support the discretionary ability if it is introduced on consensual basis within a country having serious transparency and trust problems and where the conditions for economic growth are weak. Strong economic performance is associated with higher trust level towards governmental institutions, whilst worse economic performance is more likely to entail low trust level leading to a vicious circle, and thus, to the need for trust building via fiscal institutionalisations.

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IMPACT OF FISCAL POLICIES CHANGES ON THE BUDGETARY REVENUES AND SUSTAINABLE ECONOMIC GROWTH

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ABSTRACT – *This paper presents the theoretical background of a Social Accounting Model for the Romanian economy, used to estimate and forecast the main indicators of the NIPA system, Balance of Payments, Government Accounts and Monetary Survey. In particular, the paper focuses on various scenarios concerning the budgetary revenue forecasts and economic growth for the Romanian economy for 2011-2012 in relation with the fiscal policies. For each of the alternative scenario the direct effects of the fiscal policy (budgetary) and the indirect effects (economic growth) are measured. If the direct effects are purely accountancy results of the new taxation quotas, the indirect effects consist in the influences of the new fiscal policy on the new macroeconomic indicators and the impact of such changes on the budgetary revenue.*

1. Introduction

The problem of economic growth acquires new valences under the circumstances of permanent globalization and economy turning into the “knowledge economy”. In order to solve these complex problems, a whole system of econometric forecasting methods and financial programming techniques were developed. But the model building has always represented a difficult approach and few countries have operational and feasible models.

If such an approach is difficult in the case of developed countries, what could be said about the countries like Romania, with market mechanisms in formation and generalization, where conceiving classic econometric models sometimes represents an activity without finality. Due to the specificity of the Romanian economy (weak institutional structure and no long time series), models like the ones used by IMF and the World Bank become more plausible and useful, with a reduced share of behavior equations.

In this paper are presented some fiscal policy simulation scenarios by using a financial programming model (SAM-MEGA¹) for the Romanian economy (weakly structured). The purpose of the paper is, thus, twofold: (i) to estimate the dynamics of the GDP, employment and wages as a response to the fiscal policies changes, (ii) to investigate the impact on the budgetary revenues and expenditures by the direct effects of the fiscal policies and by the indirect effects of the economic growth changes.

The next section presents the particular features of the model used for fiscal policy simulation analysis, section 3 reports the results of the scenarios, and section 4 draws some conclusions.

2. Some features of the model used for budgetary forecasts

SAM-MEGA model forecasts the main indicators of the national accounts (the GDP components for the supply and demand part) and a large set of indicators grouped on several blocks according to the structure agreed by IMF for the financial programming: General Consolidated Budget, Balance of Payments, Exchange rate, Labor cost, Monetary Indicators.

As a general structure, the model resembles the IMF and World Bank integrated model but the forecasting equations and the blocks of indicators were conceived differently to meet the specificity of the Romanian statistics. A few original elements adopted within the model for the budgetary forecasting can be mentioned:

- Forecasting and decomposition of the gross added value by the method of the factors revenue: employees' remuneration (consisting of the net salaries in the national economy, the social contributions of both employers and employees, the income tax), the self-consumption and other non-salary income, the economic agents profits - the macroeconomic indicators of labor cost and salary remuneration are forecasted in Labor cost block;
- The model explicitly forecasts the revenues of the institutional sectors for the Romanian economy, a necessary approach for the correct forecasting of the consolidated budget revenues through a direct relation with the national account indicators. On the other hand, this creates the possibility of a more realistic evidence of the resources of the hidden economy growth, as well as the quantification of the economic agents behavior;
- Introduction of the block of equations concerning the interdependence between the product/production taxes in the GDP structure and the direct and indirect taxes within the general consolidated budget. Thus, a clear connection is established between the general consolidated budget block and the national accounts block;
- The capital account of the public sector is calculated in accordance with an own methodology by using the statistical information available in the State Treasury Balance Sheet, Public Debt Account respectively;
- The explicit calculation within the model of the current accounts and the capital accounts of the institutional sectors should be particularly emphasized. This extension provides additional and extremely useful information regarding the functional behavior of sectors as a reaction at the

¹ The model was improved by the author within the POSDRU/89/1.5/S/62988-1.5 "Doctoral and post-doctoral programs in order to support research", Project "Scientific Economic research, support of welfare and human development in the European context".

fiscal, budgetary and monetary policies under implementation. Thus, the simulations that become possible can significantly increase the efficiency of the macroeconomic policies mix in order to avoid structural unbalances and social tensions and to ensure the sustainable development of our society.

One of the main purposes of the model is represented by the forecasting of the budgetary revenues and expenditures, and, resulting thereof, the analysis and assessment of the financial policy measures' impact. The revenues depend on the level of the taxation bases. The most important of them are official gross wages in economy, official gross profit, market private consumption and imports. The taxation bases are forecasted according with GDP and aggregated demand forecasts.

The mechanism based on which the change in fiscal policy entails GDP change is the following one: any shock in the fiscal policy, particularly related to a fiscal relaxation, would entail a surplus of factors' incomes which, at their turn, would generate a surplus of aggregated demand (consumption and investments). This surplus would be carried out forward to GDP and imports, so that, in the end, gross value added would be adjusted, thus determining the increase of gross salary earnings and new jobs on labor market.

3. Results: Fiscal policies changes and the budget scenarios

In this section two practical applications of the model are presented to evaluate the impact of the fiscal policies on the evolution of the budgetary revenues and on the economic growth. For every alternative scenario variants both the direct (budgetary) effects of the fiscal policy and the indirect effects were quantified. If the direct effects are accounting results of the new tax rates, the indirect effects consist in the influences of the new fiscal policy on the macroeconomic indicators and the impact of their changes upon the budgetary revenues.

In order to forecast the budgetary revenue it is imperative to define a baseline scenario, which should meet the following requirements: updating of the macroeconomic indicator forecast in relation with the first part of 2011 and the maintenance of the same fiscal policy in 2011-2012 as the one from 2010. The next stage after developing the baseline scenario is to build alternative scenarios, containing the suggested fiscal changes. The alternative scenarios are the following:

- Variant 1: flat tax relaxation by 4%;
- Variant 2: security contribution decrease by 3 percentage points and minimum wage increase from 165 euro to 200 euro.

The baseline scenario

Starting from 2010, Romanian economy evolved towards gradual improvement of the downward trend of certain indicators, as well as towards the consolidation of the upward trend of the main indicators related to supply, which have pointed out the end of the crisis. The improved evolution of economic sectors beginning with 2011 led to GDP growth by 1.6% in QI 2011 compared with QI 2010 and to the exit from recession, since growths were recorded for two consecutive quarters against previous period.

The baseline scenario for 2011-2012 foresees the continuation of positive effects of economic growth recovery recorded in the first quarter of 2011. Industry and exports would be further the main catalyst elements of economic growth. On the labor market, in the private sector, over 80 thousand employees are to be hired in 2011, after losing 160 thousand employees during the crisis year 2010. As for the governmental sector, the employees' number would decrease with 40 thousand persons in 2011, the same with 2010, due to the measures meant to restructuring government expenses negotiated with IMF. As for the economic growth, the main targets of the forecasting in the baseline scenario, for the 2011-2012, are:

- GDP will accelerate the growth from 1.5% in 2011 to 3.9% in 2012;
- Gross fixed capital formation (investments) will be the most dynamic component of the domestic demand;
- The government consumption will decrease with 1.1% in 2011 and will have a moderate growth of 1.4% in 2012, as a consequence of the restrictive budgetary expenditures, planned according to the fiscal reform in the Government Program;
- The economic growth will be accomplished under the circumstances of an improvement in the domestic and external competitiveness of the economy, which will determine:
 1. exports of goods will increase with an average of 10.5%, being supported by the improvement of the external economic environment, by the increase of foreign investments, as well as by the mechanism of promoting the exports;
 2. imports of goods are estimated to increase slower than exports, by an average of 9.5%, in the context of the dependence of economy upon imported energetic resources, as well as by the need to support investments (technology) from abroad.
- The share of the budget deficit in GDP will be maintained within sustainable limits;
- The inflation rate will be gradually reduced, reaching 3.5% in 2012.

Under the conditions where the fiscal policy for 2011-2012 would remain unchanged as compared to 2010, while the macroeconomic indicators would be those from the below table, the following are to be noticed:

- The increase of total revenues weight in GDP from 32.5% in 2010 to 33.3% in 2012, mainly determined by the increase of VAT weight in GDP by 0.9 percentage points and the increase by 0.6 percentage points of EU assistance;
- Under the conditions where total expenditure weight in GDP falls from 39% in 2010 to 36.3% in 2012, the budgetary deficit for 2012 in the baseline scenario would reach -3%.

Baseline Scenario

	2010	2011	2012
Economic growth GDP (%)	-1.3	1.5	3.9
Final consumption (%)	-2.1	1.3	3.4
Gross capital formation (%)	2.7	2.8	5.1
Exports (%)	13.1	10.2	10.6
Imports (%)	11.6	9.4	9.7
Budget revenues (% GDP)	32.5%	32.9%	33.3%
Budget expenditures (% GDP)	39.0%	37.3%	36.3%
Budget deficit (% GDP)	-6.5%	-4.4%	-3.0%

The alternative scenario, variant 1: flat tax (profits and personal incomes) decrease by 4%

The reduction of flat tax, in case of profit and income, by 4 percentage points is meant to entail the accelerated recovery of supply and investments; moreover, this measure does not have inflationary impact, being tempered by maintaining a standing exchange rate. Since fiscal relaxation is planned for July 1st, 2011, its effects are to be half felt in 2011, but would be plenty manifested in 2012.

The multiplicative effect of the surplus of income and profits would entail the increase of internal demand and supply which, at their turn, would lead to the increase, in average, of gross salary earnings and to the generation of new jobs. The GDP growth would change from 1.5% (baseline scenario) to 1.8% in 2011, respectively from 3.9% (baseline scenario) to 5% in 2012. The number of employees would rise by, at least, 15 thousand people in 2011, and by 60 thousand people in 2012, as against the level forecasted in the baseline scenario.

Alternative scenario -flat tax decrease by 4%

	Baseline	Alternat.		Baseline	Alternat.
	2011	2011		2012	2012
Economic growth GDP (%)	1.5	1.8		3.9	5.0
Consumption (%)	1.3	1.6		3.4	4.7
Gross capital formation (%)	2.8	2.9		5.1	6.4
Exports (%)	10.2	10.2		10.6	11.5
Imports (%)	9.4	9.4		9.7	11.0

Despite of the fact that flat tax relaxation has positive effects, stimulating labor, investments and economic growth, however, a decrease is expected for the overall budget revenues by 1.5 billion Lei in 2011 and by 2.5 billion Lei in 2012 as compared with the baseline scenario. This is a result of direct negative effects compensation by indirect positive effects:

- Direct effects: reduction of revenues from taxes on income and profit weight in GDP from 5.3% to 4.1% in 2012, namely revenues with 6 billion Lei lower as compared to the baseline scenario;

- Indirect effects: the increased weight in GDP of revenues from social contributions, VAT and excise duties from 20.6% to 20.8% in 2012, namely additional revenues of 3.5 bill. Lei compared to the baseline scenario, entailed by encouraging consumption and employment.

The advantage of simulating the impact of a fiscal relaxation measure with an economic model consists exactly in the estimation of this measure's effect upon widening the tax bases that would entail additional revenues to the budget. A purely accounting calculation is dangerous, distorting the economic reality of the respective measure impact; thus, in case of reducing the flat tax by 4 percentage points, the budgetary revenues would have fallen with 6 billion lei compared to the baseline scenario, instead of 2.5 billion lei as resulting from the calculations made using the model.

The alternative scenario, variant 2: security contribution decrease by 3 percentage points and minimum wage increase from 165 euro to 200 euro (measure to be implemented on July 1st, 2011).

The proposal to increase minimum wage is imperatively necessary for Romania's economy, due to its low level and to employment concentration around low income. However, this measure alone would entail the inhibition of supply and the increase of labor cost on short term, as well as the fast increase of demand that could entail an inflationary shock.

Minimum wages indexation by 20% would lead to the increase of average gross salary earnings by 2.5% in 2011 and by 5% in 2012, since the only professional categories which are affected would be those with low salary earnings. In order to minimize the financial effort of salaries increases, the social contributions on the employers' side must be diminished by 3 percentage points, this being the optimal value resulting from the model's simulations.

Alternative scenario - security contribution decrease by 3%

minimum wage increase by 20%

	Baseline	Alternat.		Baseline	Alternat.
	2011	2011		2012	2012
Economic growth GDP (%)	1.5	1.6		3.9	4.0
Consumption (%)	1.3	1.4		3.4	3.6
Gross capital formation (%)	2.8	2.8		5.1	5.2
Exports (%)	10.2	10.2		10.6	10.6
Imports (%)	9.4	9.4		9.7	9.9

This package of measures has a moderate effect upon GDP growth, being only entailed by the positive effect of increasing salary earnings that would encourage consumption. The fiscal relaxation of security contributions would not allow the companies to allot funds for investments, but to compensate the additional labor cost.

At the budgetary level, the effects of both economic policy measures are combined, allowing the revenues to remain unchanged:

- Direct effects: net impact upon revenues from the reduction of legal quota by 3 percentage points consists in the diminution of revenues with 0.6 billion Lei in 2011, respectively with 1.2 billion Lei in 2012;
- Indirect effects: additional revenues of 0.6 billion Lei in 2011 and 1.2 billion Lei in 2012, resulting from consumption encouragement (VAT, excise duties) and the increase of salary earnings (taxes on income).

4. Conclusions

The main conclusions resulting from the model regarding the medium term evolutions, under the circumstances of the reforms and the mechanisms proposed by the fiscal relaxation, are the following:

- After the end of recession, which lasted 2 years in Romania, the application of economic policy measures is imposed in order to ensure economic recovery and to consolidate sustainable economic growth;
- One of the factors encouraging the economic growth and improving the employment by reducing the “hidden economy” is the fiscal relaxation. According to the model results, the best policy measure for Romania is the one consisting in the reduction of flat tax by, at least, 4 percentage points; in these circumstances, the medium term economic growth (2011-2012) will continue to have a high level - of more than 5% - and will continue to be sustainable, even if the public finance will be less balanced due to the fiscal relaxation;
- The fiscal relaxation will affect the budgetary revenues (mainly the direct taxes) by 1 percentage point as share in GDP on the short term; on medium and long term, the economic growth would be able to ensure the surplus of revenues necessary to fill the gaps entailed by fiscal relaxation;
- In order to preserve the target of budgetary deficit weight in GDP of 3% in 2012, other compensatory measures would be needed for supplementing budgetary revenues with, at least, 2.5 billion lei;
- Some pragmatic solutions to increase the budgetary revenues and to consolidate the public finance on medium term, are the following:
 1. Tax collection rate increase by fiscal control strengthening;
 2. Tax base extension by the taxation of agricultural lands at market value. Since the price for a hectare of land outside localities should not fall below some hundreds of Euros, an average taxation with 20 euro per hectare per year would be entirely reasonable. The 15.7 million hectares of agricultural land would thus entail about 215 million Euros (about 0.3% of GDP) net gain for the consolidated budget;
 3. Increase of budget receipts from the privatization of the viable units from the portfolio of the Authority for State Assets Recovery and from the closure of those (consuming subventions) without survival chances.

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ANALYSING DRIVERS OF AND BARRIERS TO THE SUSTAINABLE DEVELOPMENT: HIDDEN ECONOMY AND HIDDEN MIGRATION*

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ABSTRACT – *Already the economists have established a relationship between tax rates and size of the hidden economy. The higher is the level of taxation, the greater incentive is to participate in hidden activity and escape taxes. On the one hand, coming from general accepted findings of the theory, we concentrate on evaluating the reasons of agents to be involved in hidden economy and estimating the size of this part of economy. In the same time, there are evidences of an extended hidden migration together with an increasing official migration usually from eastern EU members to western countries. In a sense, hidden migration could be in relation with proper hidden economy. So, on the other hand, using some indirect procedures, we try to estimate the size of hidden migration. Finally, we shall estimate the overall impact of the hidden economy and migration phenomenon on the official side of economy and its potential of growing in the future. The main application of developed methodology in this way will be in case of Romania. However, in order to extent certain conclusion, the situation in case of other EU countries will be investigated.*

Keywords: *Hidden economy, Tax evasion, Geographic labour mobility, Immigrants workers, Hidden migration, Remittances*

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1. Introduction

Although before 1990, during the communist regime, it was recognised a so-called parallel economy (a kind of informal economy) functioning outside of the official economy, only in transition period occurred estimates of size of the informal economy in Romania. Moreover, last years, under the extending migration phenomenon, there is an increasing preoccupation to estimate its invisible part to

be added to the domestic hidden economy. In the first part of this paper we present some estimates of the size of informal economy in Romania and in the second one, coming from available data and other published information, we try to build a schedule in order to obtain some estimates of hidden migration.

2. Estimating the size of informal economy

As method to estimate the size of informal economy for last years, we used one based on the correlation between the official registered average income per capita in households and the income obtained by their participation in informal activities. Based on some old research (see, Albu, 2004), we demonstrated empirically that one of the most significant determinants of the participation in informal activities is the average income per person in household obtained in formal sector. Moreover, the households' behaviour is sometimes fundamentally different between groups of population. The most synthetic expression of this idea could be as follows: along with their formal income growth, the households tend to wish to obtain more and more informal income in absolute terms, but in the same time the share of informal income in the total income tends to decrease (sharply down until a reasonable average level of formal income is obtained and slowly down in the case of the richest households). Probably, the main reason why the rich people could be involved in the informal sector is provided by the attempt to avoid in a certain proportion the taxes, according to an optimising strategy as is the case of rationale agents.

Data obtained from some special surveys organised in Romania facilitated us to estimate the parameters for the correlation between income in households from official sector and their participation in informal activities. Now, we present only the final results and the strategy we used in order to extent estimation procedure from households' population in survey to the entire population at national level. Certain behavioural regimes were outlined in matter of potential implication in informal sector. Thus, in the case of poor households (obtaining relative low income from their activity in the official sector) there is a large availability to work also in the informal sector. On the other hand, in the case of rich households (obtaining relative large income from their work in the official sector), their availability for informal jobs becomes smaller; however still remain the temptation for riche people to accept informal jobs in order to supplement their income or perhaps to avoid taxation. Despite of the general decreasing tendency of the share of expected (desired) informal income along with the growth of the basic income of household obtained in the official sector, in absolute terms the expected informal income has an increasing tendency.

In order to estimate the size of hidden income, we used the hypothesis of a hyperbolic-type function for $z\%(v)$ – the share of hidden (informal) income (function of the average level of income per person in household obtained in the official sector, v) in the total average income per person in household. Thus, to estimate the coefficients we selected as basic regression equation the following one:

$$z\% = a / (v + b) + (1 - a/b) + u \quad (1)$$

where a , b are coefficients, and u is residual variance.

Then, using the estimated values of coefficients we can write, along with changes in the level of formal income, the expected trajectories, as follows (see for details, Albu, 2004):

$$ze\% = a / (v + b) + (1 - a/b) \quad (1')$$

$$ze(v) = [(b - a) / a] \cdot v + (b^2 / a), \text{ with } ze(0) = (b^2/a) \quad (2)$$

In order to estimate the real level for informal income, according to the available data from surveys, we used two sub-samples, noted as A and B. In the case of the sample A, the function of informal income share reflects indirectly the impact of changing the proportion of households operating in the informal sector (or equivalent the impact of changing the probability for a household to be involved in the informal sector) along with the growth of the formal income per person in household. Consequently, it could be used directly to expand the estimation procedure to the national level. An impediment remains: it is implicitly supposed the same distribution of the entire population by formal income as in the case of the sample A. On the other hand, within the sample A there is a sub-sample B comprising only the households obtaining informal income. In this case, to simply extrapolate the $z\%(v)$ function to the entire set of households' population is not a good solution (it is the case of the so-called hypothesis of a generalized informal economy). Thus, we have to amend the $z\%(v)$ function by multiplying it by the probability function computed by deciles of formal income. As a first step, we amended the last estimating equation by adding a supplementary equation concerning the probability for a person in a household to be involved in informal activity. It was estimated by regressing, within the sample A, the proportion of persons in household obtaining effectively informal income in the total number of deciles of formal income in which they are located (the total number of this special category of household is just the sub-sample B):

$$p = a \cdot d + b + u \quad (3)$$

and from which the equation (2) was rewritten as

$$zpe(v) = ze(v) \cdot pe(d) \quad (4)$$

where d are deciles ($d=1...10$); $pe(d)=ad+b$ is the estimating equation of the probability for a person in a household to be involved in informal economy, p ; a and b are coefficients, and u is the residual variance in equation (3). The estimating procedure (4) is noted as C. Moreover, we extended the three estimating procedures, A, B, and C, to the national level over the period 2000-2007. In order to conserve the estimated values for coefficients in case of extending the model to the national level, all data on income from used surveys were expressed in constant prices.

The conclusion was that over the period 2000-2007 the share of informal income decreased in Romania from 21.7-22.3% in the total income of households to 14.6-15%, as we can see below in Table 1. Under the very improbable hypothesis of a generalised participation in informal activities (in theoretical

case when all household are involved in informal activities, as in case of the sub-sample B), the computed share decreased from 33.7% in 2000 to 24.8% in 2007. The main factor of this favourable dynamics of informal income was the growth of the official registered income (+78.9%, from about 104400 to 186700 Lei/person/month, computed in 1995 currency and prices, as they are originated in the first used survey).

Table 1. Average shares of informal income in the total income of households

Years	z%M	zp%M
2000	22.3	21.7
2001	21.2	20.6
2002	20.7	20.2
2003	19.6	19.3
2004	17.6	17.6
2005	17.2	17.3
2006	16.3	16.5
2007	14.6	15.0
2008	12.9	13.7
2009	12.6	13.5

Interesting conclusions could be extracted in the case of analysing by deciles the dynamic process of involvement in the informal sector. In Appendix 1 are presented the three matrixes comprising the shares of informal income within the total income in the case of the deciles for each year of the period 2000-2007, corresponding to the three estimating methods. In Appendix 2 is presented the contribution of deciles to the total informal income at national level, also corresponding to the three methods.

Figures 1 and 2 show the estimated dynamics of the average share of informal income in total income at the national level, based on the two estimation procedures, A and C, over the period 2000-2007 (the year 2000 is denoted as 0 and 2007 as 7), and its relatively strong inverse correlation with the distribution of formal income grouped by deciles (deciles are noted as $i=1...10$, and years as $j=0...7$). z%M represents the yearly average share of the informal income in the total income at national level, resulted from the regression equation based on the procedure A (sample A) and zp%M from that based on the procedure C (applying the regression equation on sub-sample B amended by the probability function).

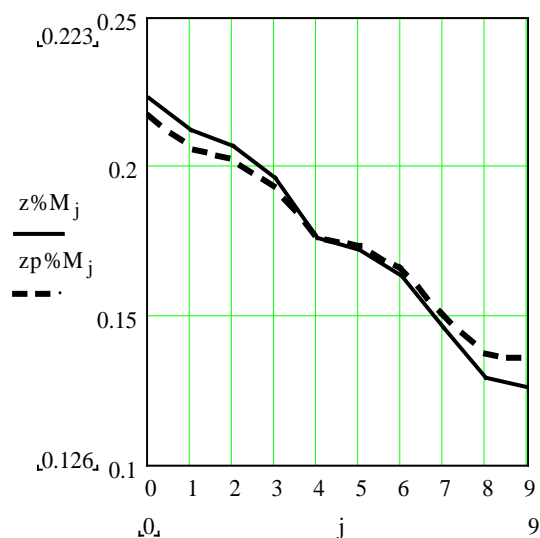


Figure 1.

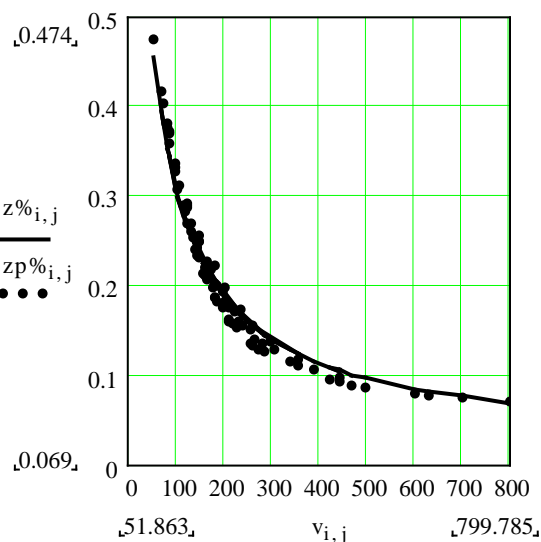


Figure 2.

3. Estimating the size of hidden migration

Like all studies on migration, a relatively poor and inconsistent base of underlying data and information supports the presented analysis. As a rule, taking into account natural dynamics of population and data on migration, between demographic statistics, including migration data, and labour force statistics should be a determined relation. Unfortunately, the official statistics is operating only with the so-called final migration (international migration determined by change of permanent residence). Thus, by channels of vital statistics and registered migration, from total existing population to the total active population could occur some discrepancies. They could be interpreted just as “hidden” migration. Some reason could be find in the definition of migration as it is considered by legislation. For instance, a person travelling abroad, initially declared as tourist (thus, for a period less than 3 months), could renew many times its stage abroad or could remain indefinitely abroad trying to find a job there or working on official or black labour market. In case of his/her EU country, this person will continue to be included in the total number of population (also, in active or inactive population).

In all countries, the problems with counting international migrants and measuring (workers’) remittances are difficult. Official estimates contain very large errors in both overstating and understating actual stocks and flows. Such difficulties are exacerbated by the prevalence of undocumented migration and (in some cases of European Eastern countries) by the problem that many people who had lived permanently in one location suddenly were counted as “foreign-born” and hence as migrants when national boundaries were adjusted after the splitting process (Soviet Union, Yugoslavia, and Czechoslovakia). These impediments make it difficult to document migration, draw inferences on its impact, and prescribe policies to optimise the role of migration in enhancing growth and poverty reduction.

Based on official statistics, we estimated indirectly the potential number of economically active population of emigrants (EP), for the period 1998-2009, as it is shown in Table 2. The analysis of the registered data for labour force demonstrated last twelve years a dramatic decrease in the activity rate

(from 70.8% in 1997 to 63.1% in 2009), which could be non-realistic (even in case of some methodological changes). International experience shows that large structural changes in labour force are questionable in such short period (a decade being considered short from historic viewpoint, because the structure of demographic system has usually large inertia). In order to estimate a more realistic number of inactive labour force, we are interpreting data from a viewpoint of human behaviour and potential involvement of a person in economic activity. Thus, although for official statistics the definition of economically active population includes only employed population and ILO unemployed, we extended the notion of active population to all persons having a potential to work but actually not included either in employed group or in unemployed group (this group of population could be interpreted as a “reserve army”). Some of them are living in country or work in informal sector, but others are already working abroad without any registration in the official statistics in their country of origin. Consequently, they continue to be included artificially in the category of economically non-active persons. They are inactive for the origin country, but they could be active in destination country.

Estimated number of inactive population we obtained by using two hypotheses: H1) maintaining for the entire period 1997-2009 the share of inactive population within the total number of persons of age between 15-64 years at the same level as in 1997; and H2) applying the same procedure but in case of the extended population of 65 years and over.

Table2. Inactive population and emigration potential, 1998-2009 - thou persons –

	Year	H1				H2			
		NAP1	NAP*	EP*	A/R*	NAP2	NAP**	EP**	A/R**
		Age 15-64				Age >14			
0	1997	4479	4479			6698	6698		
1	1998	4703	4473	230		6919	6710	209	
2	1999	4748	4472	276	46	6963	6725	238	30
3	2000	4790	4483	307	31	7054	6760	294	56
4	2001	4964	4488	476	169	7272	6791	481	186
5	2002	5443	4367	1077	600	7936	6641	1295	815
6	2003	5637	4378	1259	183	8186	6673	1513	218
7	2004	5529	4387	1142	-118	8216	6699	1517	4
8	2005	5662	4397	1265	123	8400	6728	1672	155
9	2006	5468	4398	1069	-196	8209	6728	1482	-191
10	2007	5568	4394	1174	104	8255	6727	1528	46
11	2008	5580	4392	1188	14	8295	6724	1571	44
12	2009	5542	4386	1157	-32	8300	6718	1582	11

Notes: H1 and H2 are the two considered hypotheses; NAP1 and NAP2 – the officially reported number of economically non-active persons in case of population of age between 15-64 and in case of all population over 14 years respectively; NAP and NAP** – the estimated level of NAP1 and NAP2; EP* and EP** – the number of potential stock of emigrants; A/R* and A/R** – the number of added (+) or returned (-) emigrants to/from the stock of emigrants abroad.*

From official statistics, we can see a strange situation during the period 1997-2009: despite of a significant decreasing (-12.7%) of the total number of population between 15-64 years, the number of inactive persons in this group of population registered an impressive growth (+23.7%). Similar trends are in case of considering all population of 15 years and over: an insignificant increasing (+0.3%) of the total population in this group, but an impressive growth (+23.9%) of inactive persons in the same group of population.

Moreover, using the two hypotheses, we estimated the potential stock of emigrants, EP, which was between 1.16-1.58 millions persons in 2009. The result is close to the data estimated for Romania by the Migration and Remittances Team, Development Prospects Group, World Bank – 1,244,052 persons in 2005 (Ratha and Xu, 2008). In a study on recent trends of international migration into OECD countries (Liebig, 2008), the contribution of Romania to the immigration inflows was estimated at 89,000 persons in 2000 and at 205,000 persons in 2006, data that could be comparable, in average, with our estimations in Table 2 (the estimated average level was between 84,000 and 125,000 persons per year in the period 1999-2009).

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Appendix 1

Shares of informal income in total income by deciles

H1 Estimations under the hypotheses of procedure A

(regression equation on sample A)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
D1	0.454	0.380	0.393	0.354	0.345	0.351	0.344	0.309	0.281	0.271
D2	0.342	0.314	0.310	0.293	0.270	0.270	0.266	0.233	0.209	0.200
D3	0.299	0.279	0.271	0.258	0.236	0.240	0.235	0.204	0.180	0.172
D4	0.269	0.256	0.251	0.239	0.212	0.219	0.209	0.187	0.161	0.154
D5	0.246	0.238	0.234	0.222	0.203	0.199	0.191	0.168	0.147	0.140
D6	0.225	0.222	0.217	0.207	0.186	0.181	0.174	0.155	0.133	0.128
D7	0.203	0.204	0.199	0.190	0.169	0.165	0.157	0.140	0.121	0.117
D8	0.182	0.182	0.177	0.171	0.153	0.147	0.137	0.123	0.108	0.104
D9	0.156	0.158	0.150	0.145	0.128	0.123	0.116	0.104	0.092	0.090
D10	0.109	0.105	0.100	0.096	0.084	0.081	0.076	0.069	0.065	0.064
Average	0.223	0.212	0.207	0.196	0.176	0.172	0.163	0.146	0.129	0.126

H2 Estimations under the hypotheses of procedure C

(regression equation on sub-sample B amended by the regression

equation of probability sub-sample B in sample A)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
D1	0.474	0.404	0.416	0.380	0.371	0.377	0.370	0.337	0.310	0.301
D2	0.358	0.331	0.328	0.312	0.290	0.291	0.287	0.256	0.234	0.226
D3	0.308	0.289	0.282	0.270	0.250	0.254	0.249	0.222	0.199	0.192
D4	0.270	0.259	0.254	0.243	0.219	0.226	0.217	0.198	0.176	0.170
D5	0.240	0.233	0.230	0.220	0.203	0.200	0.193	0.174	0.157	0.151
D6	0.213	0.210	0.206	0.197	0.181	0.176	0.171	0.155	0.138	0.134
D7	0.186	0.186	0.182	0.175	0.159	0.156	0.150	0.137	0.122	0.119
D8	0.161	0.160	0.157	0.152	0.139	0.135	0.128	0.118	0.106	0.104
D9	0.133	0.134	0.129	0.126	0.114	0.111	0.105	0.098	0.089	0.088
D10	0.095	0.092	0.089	0.087	0.079	0.077	0.074	0.070	0.067	0.067
Average	0.217	0.206	0.202	0.193	0.176	0.173	0.165	0.150	0.137	0.135

H3 Estimations under the hypothesis of procedure B

(a generalized informal economy based on the equation of regression

used in case of sub-sample B)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
D1	0.571	0.501	0.513	0.475	0.466	0.472	0.464	0.429	0.399	0.389
D2	0.463	0.434	0.430	0.412	0.387	0.388	0.384	0.348	0.320	0.311
D3	0.418	0.397	0.389	0.374	0.350	0.356	0.349	0.316	0.288	0.278
D4	0.387	0.373	0.367	0.354	0.324	0.332	0.321	0.296	0.266	0.258
D5	0.362	0.353	0.349	0.336	0.314	0.309	0.301	0.275	0.250	0.242
D6	0.339	0.335	0.330	0.318	0.295	0.289	0.281	0.259	0.233	0.227
D7	0.314	0.315	0.309	0.299	0.275	0.271	0.261	0.242	0.219	0.214
D8	0.290	0.290	0.285	0.278	0.256	0.250	0.238	0.222	0.203	0.199
D9	0.260	0.262	0.254	0.247	0.227	0.221	0.212	0.199	0.183	0.181
D10	0.204	0.199	0.194	0.189	0.174	0.170	0.164	0.155	0.150	0.149
Average	0.337	0.324	0.318	0.306	0.283	0.279	0.268	0.248	0.229	0.225

Appendix 2

Shares of informal income in total income by years

H1 Estimations under the hypotheses of procedure A

(regression equation on sample A)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
D1	0.137	0.128	0.126	0.122	0.128	0.126	0.123	0.122	0.124	0.126
D2	0.112	0.110	0.109	0.110	0.105	0.104	0.103	0.101	0.102	0.109
D3	0.105	0.100	0.100	0.099	0.099	0.098	0.098	0.096	0.099	0.097
D4	0.098	0.096	0.097	0.100	0.098	0.098	0.098	0.095	0.096	0.096
D5	0.096	0.096	0.100	0.098	0.098	0.098	0.096	0.095	0.097	0.097
D6	0.091	0.092	0.092	0.091	0.092	0.092	0.093	0.097	0.095	0.094
D7	0.093	0.092	0.094	0.092	0.092	0.093	0.097	0.098	0.094	0.092
D8	0.091	0.096	0.095	0.096	0.094	0.096	0.097	0.098	0.093	0.092
D9	0.089	0.095	0.094	0.097	0.097	0.098	0.097	0.098	0.098	0.097
D10	0.088	0.095	0.092	0.095	0.097	0.097	0.099	0.100	0.102	0.100
Total	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

H2 Estimations under the hypotheses of procedure C

(regression equation on sub-sample B amended by the regression

equation of probability sub-sample B in sample A)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
D1	0.154	0.146	0.143	0.139	0.143	0.140	0.136	0.133	0.133	0.135
D2	0.124	0.123	0.121	0.122	0.116	0.114	0.113	0.111	0.110	0.117
D3	0.113	0.109	0.109	0.107	0.107	0.105	0.104	0.103	0.105	0.103
D4	0.102	0.101	0.101	0.104	0.102	0.102	0.101	0.099	0.100	0.100
D5	0.096	0.096	0.100	0.098	0.098	0.098	0.096	0.095	0.097	0.098
D6	0.088	0.089	0.089	0.088	0.089	0.089	0.090	0.094	0.093	0.091
D7	0.086	0.085	0.087	0.085	0.085	0.086	0.090	0.091	0.089	0.087
D8	0.081	0.085	0.084	0.085	0.084	0.087	0.088	0.089	0.085	0.085
D9	0.077	0.081	0.081	0.084	0.085	0.086	0.086	0.088	0.089	0.088
D10	0.078	0.085	0.083	0.086	0.090	0.092	0.095	0.097	0.099	0.096
Total	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

H3 Estimations under the hypothesis of procedure B

(a generalized informal economy based on the equation of regression

used in case of sub-sample B)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
D1	0.124	0.117	0.115	0.111	0.115	0.112	0.108	0.106	0.105	0.107
D2	0.105	0.103	0.102	0.102	0.097	0.095	0.094	0.092	0.092	0.098
D3	0.100	0.096	0.096	0.094	0.094	0.092	0.091	0.089	0.091	0.090
D4	0.095	0.093	0.094	0.096	0.094	0.093	0.093	0.090	0.091	0.091
D5	0.094	0.094	0.097	0.095	0.095	0.095	0.093	0.092	0.093	0.094
D6	0.091	0.092	0.092	0.090	0.091	0.091	0.092	0.096	0.095	0.093
D7	0.095	0.093	0.095	0.093	0.092	0.093	0.097	0.099	0.096	0.095
D8	0.095	0.099	0.098	0.098	0.097	0.100	0.101	0.102	0.098	0.097
D9	0.096	0.101	0.101	0.104	0.105	0.106	0.106	0.107	0.109	0.108
D10	0.105	0.113	0.111	0.115	0.120	0.121	0.126	0.128	0.130	0.127
Total	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

FUTURE TRENDS OF GENUINE WELFARE IN FINLAND

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1. Introduction

Current economic and political systems still foster economic growth as a path to happiness, and the Gross Domestic Product (GDP) remains the most important measure of societal planning and decision-making. Economists have for long recognised that the GDP is misleading as an indicator of the welfare of a nation, let alone as a measure of people's well-being, although the makers of economic policy commonly think to the contrary. (e.g. see Chambers 2000, 10) Several studies show that economic growth does not increase the happiness of the people in industrialised countries anymore (e.g. see Kahneman et. al 2003). The problemacy of using GDP as a measure of well-being of a society became apparent in practical economic policies in most industrialised countries in the early 1970s and launched the development of improved welfare indicators persuading to overcome the problems of the GDP measure. However, advancements in the area have been limited and they have not gained the general acceptance of the GDP measure.

The most famous examples of the attempts to develop improved welfare indicators are the MEW (*Measure of Economic Welfare*) -measure developed by Nordhaus and Tobin in 1973, the Japanese NNW (*Net National Welfare*) indicator developed by Uno in 1973, the EAW (*Economic Aspects of Welfare*) -measure of Zolatas in 1981, the NAMEA matrix (*National Accounts Matrix with Environmental Accounts*) in the late 1980s of Statistics Netherlands and Roefie Hueting, the ISEW (*Index of Sustainable Economic Welfare*) indicator of Daly and Cobb in 1989, its later derivative GPI (*Genuine Progress Indicator*), and the UN's Human Development Index, or HDI, in 1990. All except the HDI use as a starting point the System of National Accounts (SNA) and include the non-marketed commodities in an aggregated macro indicator in monetary terms as the neoclassical economic theory demands. HDI on the other hand is an index and is not valued.

Among the most interesting of these measures is the concept of the ISEW, the Indicator of Sustainable Economic Development, developed by Daly and Cobb (1989, 401-455), and its further derivative the GPI, or the Genuine Progress Indicator. An American organisation Redefining Progress first introduced GPI as an alternative to GDP in U.S. in 1995, and has since updated and developed the indicator. According to Castaneda (1999, 237), in addition to the United States, there have been at least six other attempts to implement the ISEW to a national economy: UK (Jackson & Marks 1994), Germany (Diefenbacher 1994), the Netherlands (Rosenberg & Oegema 1995), Austria (Stockhammer et. al. 1997), British Columbia (Gustavson & Lonergan 1994), Sweden (Jackson & Stymne 1996) and Chile (Castaneda

1999). In this analysis the Finnish ISEW has been presented and applied on the basis of Daly's and Cobb's original proposition (e.g. see Daly and Cobb 1989).

The Genuine Progress Indicator (GPI) is a further derivative of ISEW. In addition to U.S. (see e.g. Talberth et al. 2006), GPI has been calculated at least for Australia (Hamilton 1997), Scotland (Hanley et al. 1999) and France (Nourry 2008). In this article the Finnish GPI has been calculated according to the methodology presented by Talberth et. al. (2006).

2. Indicators of sustainable social progress

Hanley et al. (1999, 57) have classified the indicators of sustainable development into three major groups, namely: 1. economic, 2. ecological (environmental) and 3. socio-political. The first group includes such measures as Genuine Savings (GS). GS aims to estimate nations net investments to man-made, human and ecological capital. The second group of indicators includes among others Ecological Footprints (EF). It aims to estimate the quantities of biosphere available to mankind in physical measures and has no linkages to economic values. Purely ecological indicators have the advantage of taking the carrying capacity of biosphere into account. Their problem however is that pure quantity measures turn poorly to the languages of economic and social systems. These indicators are also often heavily determined by the size of population.

The third group of indicators contains for example Index of Sustainable Economic Welfare (ISEW), Genuine Progress Indicator (GPI) and Human Development Index (HDI). These indicators attempt to integrate into the basic economic data the essential environmental and/or social factors. Thus they have boarder perspective to economic development than the conventional GDP measure. These approximations of welfare in society give additional information about the aggregate welfare in society. As such indicators of this group all try to describe improvement in the quality of life. Opschoor (2000, 365) states that, from the theoretical economics side, a much more promising approach is to go for multi-dimensional indicators.

The Index of Sustainable Economic Welfare (ISEW) and Genuine Progress Indicator (GPI) give a better picture of people's actual well-being. However, they require the "right" pricing of environmental hazards in order to function properly. The successor of the ISEW, the Genuine Progress Indicator (GPI) was first presented by Cobb, Halstead and Rowe (1995) in 1994 and later developed by Talberth et al. (2006) in the organisation Redefining Progress. The Genuine Progress Indicator takes from the GDP the financial transactions that are relevant to well-being, namely personal consumption adjusted for income inequality. The adjustments include further economic dimensions of development, most of them externalities. The major difference of GPI compared to the ISEW is the inclusion of externalities such as crime levels and costs of underemployment. The GPI also tries to include larger share of the non-market production, by way of accounting for e.g. voluntary community work.

3. Application of economic welfare indicators to Finland

3.1 Structure of Finnish National economy

Finland is today one of the most developed and industrialised economies and one of the richest countries in the world. Although one of the least developed countries in Europe after Second World War, Finland has rapidly industrialised and turned to a welfare state by using large quantities of natural resources. Today the Finnish economy is one of the most natural resource-intensive. The welfare of Finland is thus achieved by exporting ever increasing amounts of natural resources in the form of commodities. The major driving forces behind Finnish economic growth have recently been European Union membership in 1995 and the globalisation of world markets since late 1990's. The consumption of natural resources has pushed up the economic growth over time. (e.g. see Hoffrén & Hellman 2007).

The material-intensive branches of industry, namely, pulp and paper, basic metals and chemical industries, continue to form the industrial backbone of Finland, even though the share of less material-intensive sectors, such as service and electronic industries, has increased significantly since the 1960s and 1970s. In 2007, metal, electronics and electrical industries accounted for 46.1 per cent, forest industry for 19.6 per cent, and chemical industry for 5.1 per cent of the total industrial output in terms of value added. Basic metal, machine and transport equipment industry products accounted for 36.1 per cent of the value of Finnish exports, electro technical industry products for 23 per cent, electronics industry for 24.7 per cent, forest industry for 19.3 per cent, and chemicals industry for 14 per cent (National Board of Customs (2008)).

3.2 The economic development of Finland as depicted the GDP

The Gross Domestic Product (GDP) measure is commonly used to depict the progress of Finnish economy. However, the GDP measures the level of all production and excludes the external effects of production. Thus the GDP fails to emphasise the environmental hazards adequately. This problem originates mainly from the absence of market prices for environmental commodities. It is also worth noting that in the basic economic theory, welfare is derived from consumption, not from production. This should be kept in mind while analysing the development of Finnish GDP -time-series. As can be seen from figure 1, the Finnish GDP grew quite steadily from 1945 till 1990. The growth of GDP from 1945 on depicts the vigorous and continuous transformation of Finnish economy from closed market society to open market economy. There is only one exception to this trend, the economic recession of the early 1990's that hit Finland hard. Due to this economic recession, the GDP turned down and descended till 1993. During the recession unemployment rose sharply, bankruptcies became a common issue, foreign trade shrunk and general economic development weakened. Upward turn begun in 1994 and since then GDP has been on continuous growth path. After the recession, the growth of GDP has been rapid, and the 1990 level was reached in 1997. There was a period of slower growth between 2000 and 2003, after which that the Finnish GDP has been growing forcefully till autumn 2008 when global financial crisis begun to create much doubt about the direction of economic development. Overall GDP gives very positive picture of the Finnish development, without any disturbing signs about global

warming, growing environmental burden of economic activities, over exploitation of natural resources or imbalance of income distribution. Thus the GDP simply misguide the society to think that we were on the right track.

3.3 Basis of the Finnish ISEW and GPI

The compilation of the Finnish ISEW was based on the ideas presented by Daly and Cobb (1989). Methodology of Finnish ISEW calculation followed the original ideas very faithfully. The time-series from 1960 to 2000 of Finnish ISEW were first presented by Hoffrén (2001). Later they have been updated, converted to euros and the time-series was continued till 2010.

The methodological basis for the compilation of the Finnish GPI was the U.S. GPI calculated in Talberth et. al. (2006). Though the methodology presented in Talberth et al.(2006) was followed quite faithfully in the calculation of the Finnish GPI, on account of data limitations some changes were made. The variables Cost of Household Pollution Abatement and Cost of Ozone Depletion were left out due to lack of data. Also, instead of Value of Volunteer Work, Value of Participatory and Organizational Activities was included in Finnish GPI, and instead of Cost of Underemployment, Cost of Unemployment was calculated. Both changes were made due to lack of data on original U.S. variable. It can be also assumed that the lack of data is at least partly due to insignificance of the U.S. variable to the Finnish society, and that the included factors describe Finland better. (e.g. see Rättö 2009.) The Finnish GPI was first presented by Rättö (2009), whose time-series covered years from 1960 to 2007. Later they have been updated and the time-series have been continued by Jukka Hoffrén till 2010.

4. Analysis of the Finnish ISEW and GPI

The largest differences between Finnish GPI and ISEW are related to the monetary pricing of environmentally harmful impacts and the treatment of some social factors. In order to obtain the ISEW and GPI, factors such as unpaid household work and services obtained from consumer durables, are added to weighted personal consumption, and several phenomena of environmental deterioration and wasteful activities are subtracted from it. GPI evaluates many environmental impacts, especially the ones with long-term effects, higher than ISEW. The income index used in ISEW is on the other hand more receptive to changes in income distribution, which makes ISEW faster to react to changes in income differences. ISEW also accounts for some public expenditures that are absent in GPI. The progresses of the Finnish Gross Domestic Product (GDP), Index of Sustainable Economic Development (ISEW) and Genuine Progress Indicators (GPI) at real prices are depicted in Figure 1.

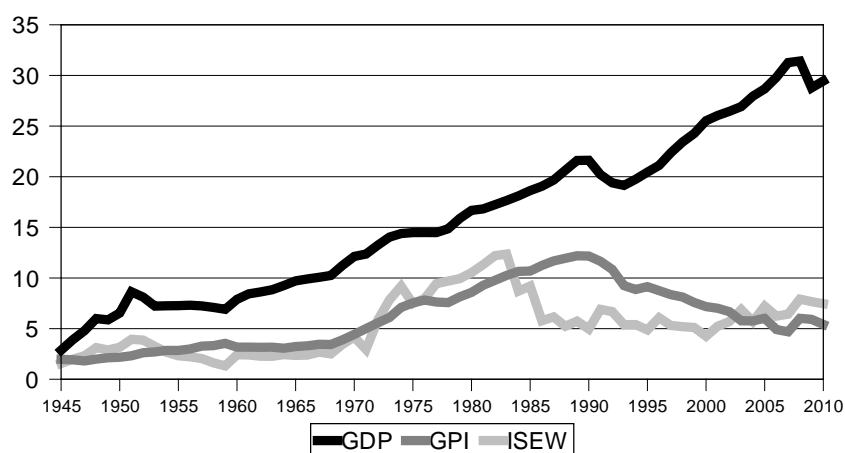


Figure 1. Progress of GDP, ISEW and GPI per capita in Finland in 1945-2010 (Euro, 2000 rp)

Figure 2 shows that both ISEW and GPI rose steadily in the 1970s and early 1980s, but have since then declined and stabilised. In case of Finland the main reason for this development is the income distribution which apportioned the welfare derived from increased production. In the mid- 1980s income disparities started to grow again, flows of capital (investments) abroad increased and environmental hazards escalated, resulting in a decline in weighted personal consumption, on which the ISEW and GPI are actually based. A further illustration of the development of the values of ISEW's positive and negative components from 1945 to 2010 is depicted in Figure 2.

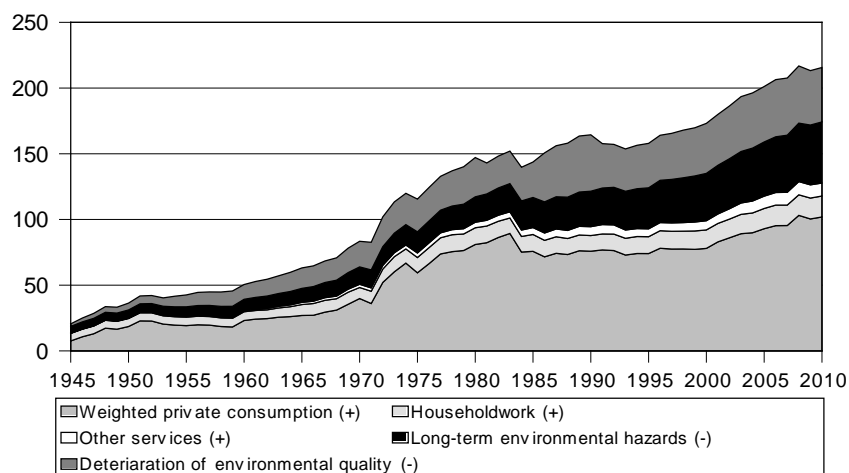


Figure 2. Progress of the components of Finnish ISEW (EUR billion, rp)

Throughout history the basis of the Finnish ISEW has been the weighted personal consumption of individuals. Since then the weighted personal consumption declined but later turned upwards. The 1991 level was gained again in 1998. The other major positive component of the ISEW, i.e. household work, has also grown somewhat in size over the years. The negative components of the ISEW, the so called environmental deterioration and long-term environmental damage, that approximates the cumulative environmental damage caused by economy, have also grown strongly. However, in 1990s the value of environmental deterioration has decreased thanks to the efficient environmental protection activities. Finally, as a general observation, it can be concluded that the ISEW measure is remarkable stable

aggregate indicator. It is by no means sensitive to any single fluctuation in the numerical value of one it comprises of.

The concept the “weighted personal consumption” concept used in GPI differs from that used in the ISEW, since the income distribution index used to weight personal consumption is constructed differently in the two indices. Figure 3 illustrates the development of GPI’s positive and negative values from 1945 to 2010.

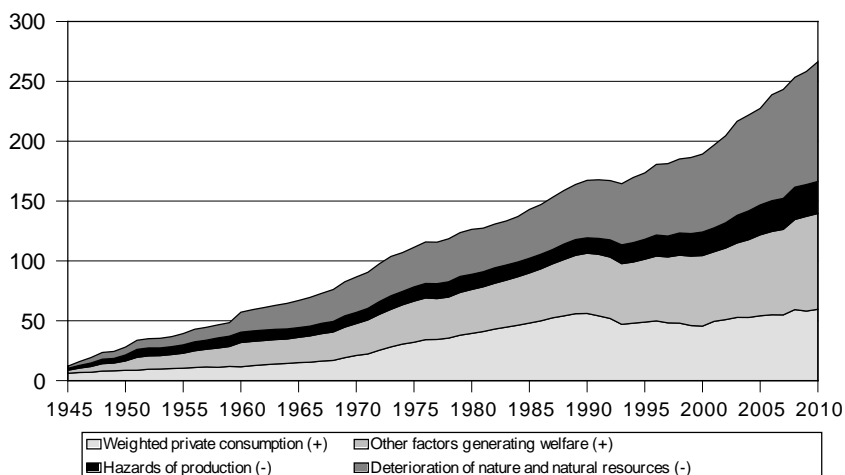


Figure 3. Progress of the components of Finnish GPI (EUR billion, 2000 rp)

Regarding to other positive contributions to welfare in GPI, it can be noted that their value has been growing quite steadily throughout the period examined. The same observation can be made of the value of the defensive expenditures, though the growth rate of these expenditures has been more moderate throughout the 1945-2010 period. Figure 3 shows that the main component of GPI, weighted personal consumption, increased from 1960 on, peaking in 1989. After 1989 the weighted personal consumption declined for four years but returned to increasing growth path in 1994. The level of weighted personal consumption of 1989 was reached again in 2006. It should be noted that, compared to the rapid growth of the Finnish GDP after the economic recession of the early 1990’s, the growth of weighted personal consumption has been much slower.

One of the important factors contributing to the slow recovery of the Finnish GPI to the level attained before the economic recession is the growing economic inequality in the society. After the early 1990’s income differences have been growing in Finland, which in turn reduces the value of weighted personal consumption. The largest negative component in the Finnish GPI is the value of environmental degradation, which includes values of both long-term and short-term environmental damages. From figure 6 it can be seen that the value of environmental degradation has grown strongly during the period examined. Especially from 1990 on the value of environmental degradation has attained a very high level. The high value of the environmental degradation in the later years of the observation period is partly due to the cumulative impacts of many harmful factors. Since for example coal-dioxide stays in the atmosphere for many years, the impact of the gas is not restricted to the year it is emitted. Cumulative environmental effects accumulate and have an impact for several years.

It can be concluded that neither ISEW nor GPI is a pure indicator of sustainable development, even though they both try to take into account the sustainability of the welfare generation of an economy.

From the compositions of ISEW and GPI it can also be concluded that GPI is more congruent with the ecological viewpoint of sustainable development while the perspective of ISEW is more related to the social point of view of sustainable development.

5. Conclusions

Despite the fact that the exploitation of natural resources and environment already exceeds the carrying capacity of the global ecosystem, the current economic and political systems still foster extensive economic growth. Although there have been numerous attempts to develop improved welfare indicators persuading to overcome the deficiencies of the Gross Domestic Product (GDP) and to comply the prerequisites of sustainable development, even today GDP remains the most important measure of societal planning and decision-making. At the same time several studies show that economic growth does not increase the well-being of people in industrialised countries anymore. On the other hand sustainable development requires us to define the sufficient level of natural resource consumption to make people happy. To ensure the maximisation of the true sustainable well-being of people principles of equity and happiness should be taken into account when discussing the sustainability.

The indicators of sustainable economic welfare, like ISEW and GPI connect economic activities with quality of live and sustainable development dimensions to give a better picture of people's actual development of welfare. Adoption of ISEW and GPI to Finnish data show that the economic growth measured by Gross Domestic Product (GDP) has not improved the economic well-being of people in Finland since mid-80's. According to ISEW -measure the welfare has established although in 2000's the ISEW per capita has slightly rose as the environmental burden of the economy has not grown as fast as private consumption. The Finnish GPI-measure peaked in 1989 and has since decreased till recent years. In 2000's the Finnish GPI has been on a the level that was last seen in the early 1970's. The picture that these two measures give of the direction of Finnish economy is a very worrying one, and differs greatly from the picture given by GDP. Results imply that GDP is today a poor policy steering indicator in post-industrialised countries. There exists a need to develop further economic welfare indicators for economic and social monitoring and policymaking.

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7. CORPORATE RESPONSIBILITY

INTEGRATING SUSTAINABILITY INTO STRATEGY AND INNOVATION

A FORESIGHT-INSPIRED SYSTEMATIC APPROACH FOR BUSINESSES

Dr. Bernhard Albert

ABSTRACT – *What is needed by businesses for robust and sustainable development is an approach which encompasses the integral and participatory identification and evaluation of environmental developments and the integration of the results into day-to-day business. Participatory processes are a good basis. They make it possible to integrate the necessary actors at an early stage and to reduce resistance to change. At the same time, they strengthen foresight capabilities and promote a holistic view of the organisation and its activities. During these processes, internal perceptions of corporate frameworks and external environments can be reconciled with the insights of external experts. This makes it possible to identify the most influencing and most influenced general developments, blind spots, and company-specific trends. Subsequently, the results can be mapped on trend landscapes and rated in trend radars. The latter are fundamental for developing strategies, assessing risks, identifying business opportunities, and initialising innovation processes. In a crucial final stage, the results have to be communicated, transferred to existing structures and processes, and continuously updated, e.g. by adding further layers to road maps, project management and product planning. An accompanying evaluation restarts the process by determining successes and changes and by providing a fresh perspective on inner and outer environments. The article ends with a brief case study on the successful implementation of such a process in a German based road groupage network.*

1. An Academic Illusion

In my ten years as an advisor and facilitator for futures research and foresight methodology, I have repeatedly witnessed that companies try to get a grip on the future by commissioning future studies or scenarios or booking foresight, strategy or innovation workshops. Unfortunately, however, this approach often is not crowned with success. Recommended measures are not implemented and the results are not or only to a limited degree communicated within the organisation. As a consequence, they are neither incorporated into strategy and innovation processes, nor into product development or change management. The situation is similar for sustainability. Here, too, businesses commission surveys, kick off certification processes, and develop sustainability reports. All too often, these are used only for external communication, without leading to real change within. As a result, companies not only achieve far less than would have been possible, but also far less than what would have been expedient for

themselves – both in day-to-day business and with a view to their own future and their own markets. Businesses which lack a clear focus on sustainability are called out for greenwashing by the media and the general public, and enterprises that fail to focus sufficiently on the future are considered to be in danger of decreasing innovativeness. For the scientific community and expert advisors, the fact that their work is often neglected or only insufficiently used and implemented remains a bitter pill to swallow.

It goes without saying that it is never wrong to observe the world with scientific means critically and forward-looking and to pass on the resulting knowledge. But it would be wrong to consider this process a one-way street. A significant part of the academic community remains convinced that executives and managers would only need some to be lectured to do their work better. Others would go so far as to consider scientists and researchers better entrepreneurs as a result of their competencies and knowledge. But experts for foresight and sustainability, in particular, should be aware that foresight and sustainability require not only specialist knowledge, but also a deeper understanding, a special attitude, and clear convictions. What is necessary for business leaders is to change their mindsets – and scientists working for and within companies will go the way of the dodo unless they change their mindsets, too.

Experience shows that foresight and sustainability play a prominent role in businesses especially if executives and employees are integrated as partners into processes of research, design, and innovation. In particular if the scientific approach and the concept of foresight and sustainability were tried out and understood in open debates were results transferred to the envisioned degree into structures and processes.

2. Foresight leads to sustainability

Thesis: Foresight is a capability combining knowledge, experience, attitude, and possibly wisdom or a well-honed intuition.

I would like to begin by explaining the principles of foresight and the steps leading from foresight to sustainability. These steps are based on the maturity model of foresight developed by Dr. Richard Slaughter (Slaughter 1996: 14 / Slaughter 1999). I have changed details on Levels four and five to emphasise how sustainability can be considered a result of foresight. This is particularly the case if we consider foresight not only an option to foresee opportunities but simultaneously an opportunity to avoid risk and to let us and our business survive over longer periods. In his maturity model, he defines five steps from unreflective use of forward thinking in daily life to long-term thinking as a social norm.

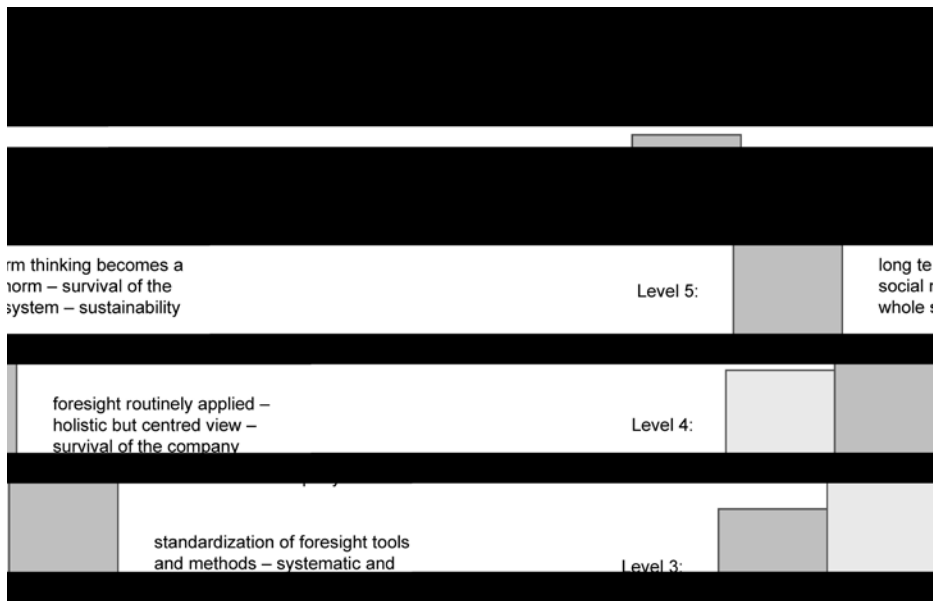


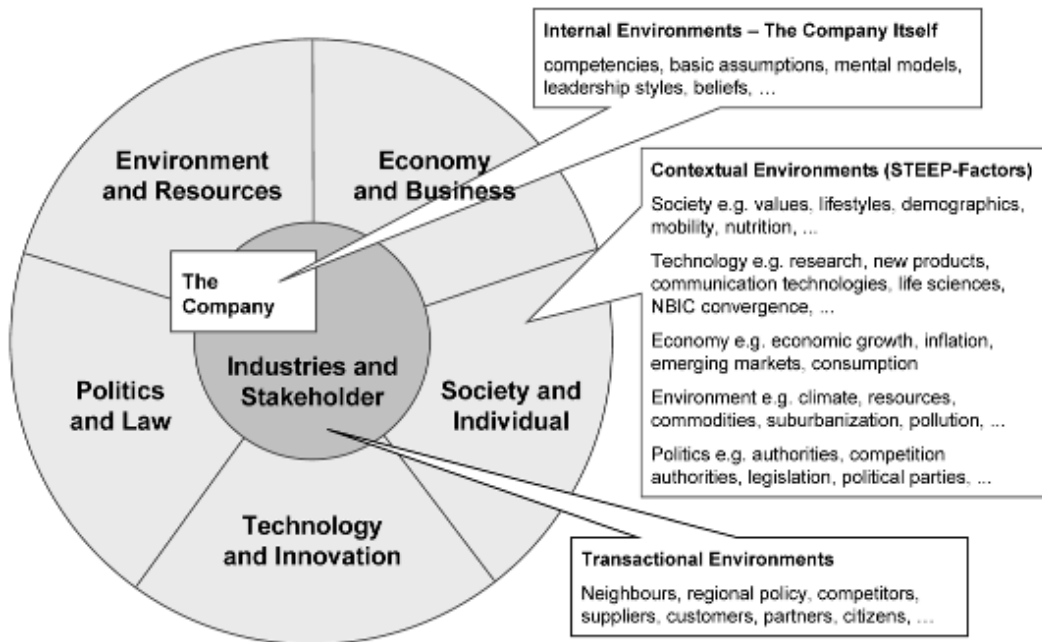
Figure 1. *Futures studies – from individual to social capacity and to a holistic perspective*

1. The most basic level of foresight is a skill we all have: Foresight as forward-looking thinking based on experience, e.g. packing an umbrella, business cards, or a Swiss knife because you might need them.
2. The next step in the development of foresight is a societal discourse on future, future concepts, and basic approaches to designing the future. In the private sphere this includes activities like decisions about building homes, childbearing preferences, or apprenticeship paths.
3. The third stage is a systematic and methodical way of anticipation. This is the basis of planning. It is at this level that people try to structure their lives and business actions; they think about the future systematically and highly structured, and make decisions based on ideas about the future or wishes for the future.
4. The fourth step brings a difference. At this level, people look beyond past experiences, they consider the situation holistically, and often integrate the knowledge of employees, customers, and experts to achieve a broad overview of possible developments. Sustainability, however, is only considered with a focus on the company as such. Leaders look at if and how their business may survive under given circumstances and which options they have to shape their own future.
5. It is only with the fifth and final step that we reach the level where foresight and sustainability find each other. Here, sustainability goes much beyond 'gazing at your own navel'. In this stage, participation and communication are of supreme importance: horizons have to be widened and underlying connections deciphered, change processes initiated and driven forward together. Here, we assure the survival of ecosystems, the protection of the environment and of mankind and secure our livelihood on planet earth. So in the fifth and final level of foresight, the focus is on the survival of the whole system.

Germany's former president Roman Herzog put it thus in 1997: "Gazing at your own navel will not yield in anything new. [...] We have to become parts of a learning global society which searches around the world for the best ideas and solutions" (Herzog 1997).

3. How do we arrive at big picture?

A business exercising foresight has to examine all major trends or future developments and determine which of these impact on its future. Here, structured analysis is indispensable. A key approach to structuring a company's environments is to define them in terms of distance and influence.



Source: after Bernhard Albert and Christoph Keller, personal conversations 2008

Figure2. Business Environments

First – the contextual environments. Referred to as PEST factors (Politics, Economy, Society, Technology) in business but more commonly called STEEP factors (Society, Technology, Economy, Environment, Politics), with the extra 'E' denoting natural environments, natural resources, and raw materials. All factors influence business and the company as such. The company, on the other hand, has little or no influence on these environments. Businesses may only react to factors such as climate, weather, peak oil, or the demographic transition.

Second – the transactional environments. The second type of environments consists of organisations and people related to the company. Its foundations are negotiations and written as well as unwritten contracts. Companies are able to influence these environments. However, they have to be aware that the ability to influence is mutual. The transactional environments can be shaped by reaction and proaction.

Third – the internal environment – the company itself. Most business leaders believe that this is an environment they fully control. However, competences, values, beliefs, traditions, and other drivers heavily influence and shape this environment. We all know how difficult it is to rethink one's value system and to say goodbye to accustomed paradigms and entrenched behavioural patterns in order to acquire new skills and take new paths. It is not without reason that change management is one of the most demanding challenges for companies.

4. The Pillars of Sustainability

Sustainability is not only the challenge to act ecologically, it is a core attitude which integrates economic, ecologic, social, and cultural aspects.

According to Paech (2005, 92ff) the popular three-pillars-model of sustainability, which is commonly interpreted in two ways, is not sufficient. According to one of the two approaches, actions are only sustainable if they fall into the intersection of all three pillars and are hence considered to be economically, ecologically, and socially sustainable. The other interpretation makes economic sustainability a precondition for any sustainable activity, granting the former pre-eminence over the other two pillars.

Whether or not sustainability economically benefits commerce as a whole or an individual company should not be a factor for, and much less a knock-out criteria on sustainability. In terms of sustainability, it may make sense to reduce the wasting of resources by targeted interventions and limitations, even including shutting down companies.

If, however, we consider sustainability to be an integral corporate task, we have every right to say that ecologic, social, and also cultural sustainability are strongly interdependent, and that sustainability as an overall concept cannot be implemented unless economic sustainability is achieved within the company's context.

The fourth pillar. Social sustainability is mostly interpreted only in terms of 'public spirited' where education and labour are concerned, and in the sense of fair wages and a just distribution of resources. Other crucial practices which contribute to maintaining and stabilising society are ignored, e.g. the opportunity to participate socially and politically or the evolution of social value systems, as well as the protection of cultures, languages, traditions, and lifestyles. To emphasise the relevance of cultural sustainability – which always includes the public discourse on sustainability – the three-pillars-model should be extended to include a fourth pillar of cultural sustainability.

Economic sustainability posits that the company act in an economical manner, securing its survival and continued success. Furthermore, economic sustainability means avoiding destructive actions within the company environments which could result in overtaxing the financial capabilities of the company or risk destroying the very basis of the business itself.

Ecologic sustainability means keeping the natural environment intact by avoiding actions which reduce or risk the survivability of ecosystems or compromise the survivability of humanity, whether through pollution, climate change, reducing biodiversity, or an inefficient protection of resources and commodities.

Societal sustainability means – in particular – to pay fair wages, to empower employees, to avoid injustice, and to contribute to a compassionate society worth living in. It includes opportunities for education and the just distribution of property, income, and resources.

Cultural sustainability means participation, acceptance and protection of cultures and lifestyles, in particular within the company's environments, its field of action. It also includes advancing cultural change towards sustainable ways of living. Ultimately, sustainability is impossible unless one recognises the ambivalence of change and the need to protect cultures.

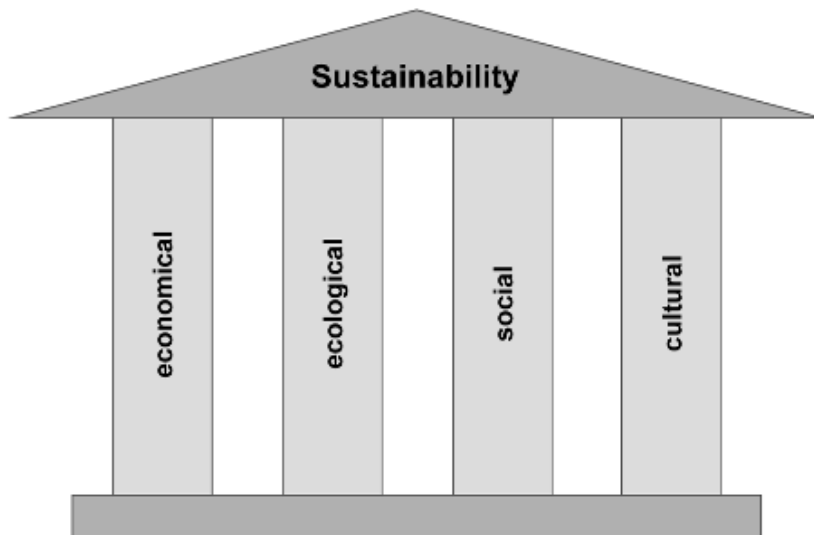


Figure 3. Pillars of sustainability – four rather than three (Source: Author)

On the road to develop sustainability, foresight is a core capability. Foresight – and the associated holistic perspective – make it possible to understand more deeply and fundamentally the drivers of developments, their frameworks, inner structures, and their wide-ranging network of interdependencies, amplifications, and impairments. It is only in this way that we may identify the key levers which make comprehensive changes possible.

5. Systematic Integration of Foresight and Sustainability

If one discusses the concept of foresight with a view to Slaughter's maturity model, it becomes evident that foresight should not be left to individuals and experts. Some indications come from, in addition to prior studies, the results of the empirical survey "Zukunftsmanagement als Erfolgsfaktor für die Investitionsgüterindustrie"¹ (Gleich, Schneider & Tyssen 2010). This study undoubtedly shows that key contributions to the success of foresight activities come from top executives clearly committing themselves to foresight activities, transparent communication of long-term objectives, both vertically and horizontally, a corporate culture focused on integration, participation of employees in innovation and change processes, and the acceptance of external knowledge.

¹ Translation: Managing the Future as a Success Factor in the Capital Goods Industry

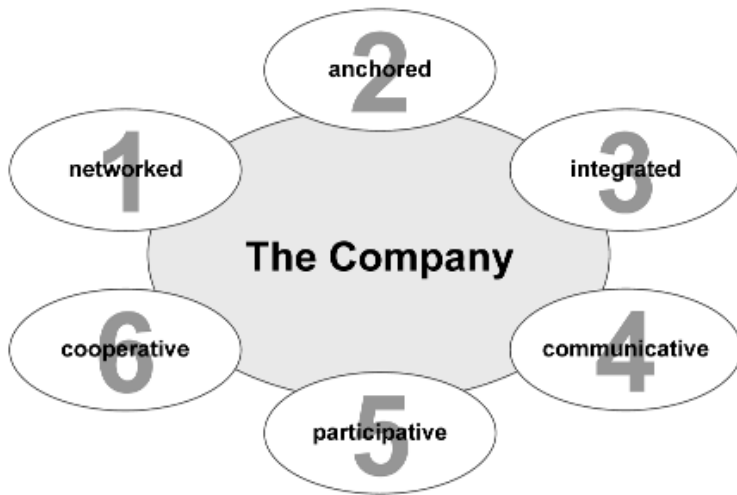


Figure 4. *The ideal of foresight in companies (Source: Author)*

If we carry this thought through, we have to conclude that the same is true for all issues which concern sustainability. Similar to foresight, sustainability is a question of communication culture, participation, use of expertise, and systematic, purpose-driven design. In other words: the concepts of foresight and sustainability will be successful in the corporate environment especially where external and internal knowledge is integrated to the same degree, and where the highest number of employees is actively surveyed, informed, and involved across hierarchy levels. Likewise, the results of foresight processes and the stages of the process itself have to be systematically integrated into day-to-day business processes, just as the concept of sustainability and its analogous tasks. One model is the control circuit below, which may be used as an example. In practice, a larger number of control circuits and processes follow each other, build on each other, and depend on each other. Methodically, there is a wide range of options for each step of the control circuit – but essential in every stage is communication, consciously shown below as the hub in the centre of the control circuit, and participation during the processes. Without these two factors, many efforts will remain fruitless or have considerably lower impacts.

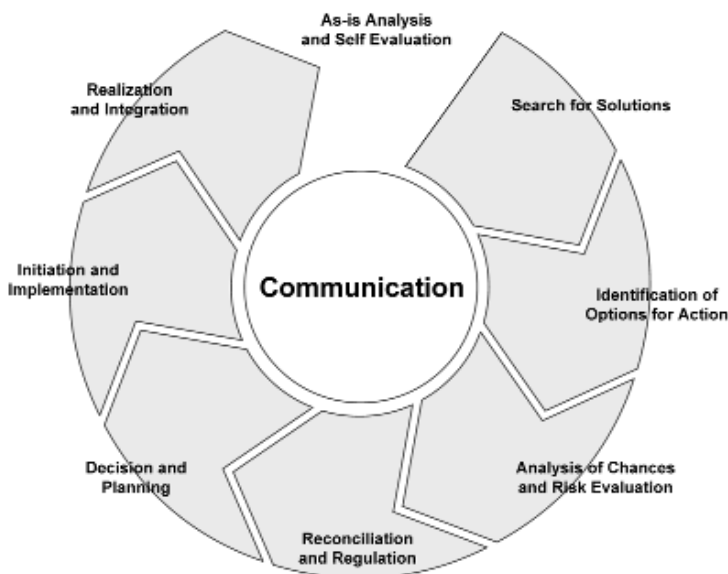


Figure 5. *Foresight as control loop (Source: Author)*

That communication, networking, and embedding of foresight are crucial for its success in companies is also emphasised in the maturity model by Rohrbeck (Rohrbeck 2011: 71ff). By showing the corresponding issues along the time line, foresight and sustainability can be systematically integrated into linear follow-up processes such as planning, project management, and roadmapping (cf. Behrendt 2007) – e.g. in the areas of product development, innovation, change management and strategy. Just as possible technology developments, fluctuating access to resources, social and legal changes, and sustainability issues can be systematically integrated. In this way, foresight and sustainability will be constantly executed in processes and in reasoning, and increase in relevance in decision-making and business processes.

6. The Foresight Process at System Alliance - a Brief Presentation

System Alliance is a German based national road groupage network, established by a cooperation of SMEs with eleven associates – international and national providers – and four so-called system partners. In view of the dynamic and often difficult to understand fluctuations in the logistics markets, recurring economic crises with global impacts, intensifying requirements as regards resource efficiency and climate protection, demographic change with ageing populations and workforces and an increasing lack of skilled labour, the network decided to take a more systematic look at the future and make itself and the involved businesses more future-oriented. Both internal and external knowledge was to be integrated in the most efficient way possible. In addition to higher executives, decision-makers and employees from all divisions, including dispatching and handling, were to be involved. The network commissioned a team of external experts with widely varying specialist areas. Prof. Dr. Thomas Krupp of the European University of Applied Sciences (Brühl) was engaged as an expert for logistics, Dr. Heiko von der Gracht of the Center for Futures Studies CEFU of the European Business School (Wiesbaden) as an expert for supply chain management and foresight for logistics, Uwe Berndt as a specialist for internal and external communication, and Dr. Bernhard Albert (Foresight Solutions) as a political scientist and expert for extensive and participative foresight. This diverse team of scientists was responsible for concepting and implementing the process, and scientific guidance throughout its run. The selected process reached wide into the network's environments and, at the same time, deep into the organisation as such. The aim was identify relevant developments for the next ten to fifteen years in order to prepare for these using adequate measures. A participative process which had been internally intensively communicated and coordinated was to lead to this goal. The results were to be published (Albert et al. 2011).

The process had been designed to last one year and run in six stages. In the first stage, external insights were collected from the scientific community and the logistics industry. The team collected, selected, and analysed existing futures and scenario studies with an emphasis on logistics and its environments. More than 900 trends were registered, systematised, and clustered. In the second stage, the team conducted interviews with owners and managing directors, focusing on perceived and expected developments in contextual, transactional and internal environments. This was followed, in the third stage, by workshops involving the associates' and partners' executives. Topics included not only future issues of the respective companies and divisions, but also options for reactions and actions. The results of this internal survey of existing, yet often still to be broadened forward-looking knowledge were, in the

fourth stage, collected and reconciled with the trends of the external foresight studies to find consensus and identify blind spots. Ultimately, 38 trends resulted which were highly relevant for logistics and System Alliance. These were then used as the basis of an online survey with some 300 respondents from all divisions and across all corporate hierarchies. They were asked to assess the trends based on their relevance for the network. Simultaneously, they had the opportunity to suggest, as had the workshop participants before, options for reactions and actions to the trends and name further trends and future issues. In the sixth stage, the results of the survey were analysed and, based on the existing suggestions and the experts' considerations, summarised to measures by the experts' team. These measures were either specific reactions to the changes evident or expected in the environments, or were intended to be used in the development of analogous responses.

The beginning of change and innovation: As a first reaction, the cooperation opted for five of these measures:

1. Making futures workshops a permanent feature. Foresight studies are to be systematically collected and analysed, supplemented by further interviews, workshops, and surveys with more focused questions based on the results of the previous round.
2. Measures for human resource development, among others as a reaction to the demographic transition and the growing challenges of the knowledge society.
3. Development of application concepts for green logistics with a view to greater sustainability and resource efficiency.
4. An annual Future Camp and innovation workshops as opportunities to develop new answers to emerging challenges in the environments as well as innovation products and new processes, and kick off cultural changes.
5. The development of a systematic shared strategy process, with a common vision, common objectives and tools to plan and manage relevant business processes.

Similar to the previous process, the focus is on participation and communication to increase foresight capability and innovativeness.

Almost more striking than the process with its highly effective design were the future issues emerging within the cooperation. First and foremost, this was sustainability with its social, ecological, cultural, and economic aspects which were not only listed in the area of environment and resources (STEEP), but were also extremely frequent in other areas of the analysis, ranging from society and individuals to technology and innovation and finally economy and business as well as industry trends in logistics. These include demographic transition and its corresponding effects, increased value orientation leading to growing demands made on and within businesses, increasing numbers of regulations and standards, relevance of certifications and life-cycle assessments, globalisation with its growing global interdependencies, the increasing relevance of renewables for manufacturing and vehicles, the higher significance of innovative traffic concepts, or the increasing economic volatility which makes higher demands on businesses as regards risk management and stability.

This is evidence of the close link between foresight and sustainability. The latter almost always gains crucial prominence when a company's environments are systematically and comprehensively examined and the company sets its sights on the mid- to long-term future. It is rarely the survival of the company alone which comes into the focus of those participating in the process, rather, highest priority is given to the continued existence of the contextual environment. This may be a sign that a large number of

companies already consider the sustainability issue to be essential for survival, and that sustainability and the affiliated value systems have key significance for businesses, executives, and employees, in particular in SMEs.

In a nutshell, participation and communication in foresight processes seem to lead from foresight to true sustainability. This will have to be researched in more detail in the future.

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DISRUPTIVE INNOVATIONS AT THE BOTTOM OF THE PYRAMID – CAN THEY IMPACT ON THE SUSTAINABILITY OF TODAY’S COMPANIES?

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ABSTRACT – *Due to the different dynamics required for organizations to serve the emerging market which contains billions of people at the bottom of the pyramid (BOP) coupled with the increasing desire for organizations to grow and be more multinational, organizations need to continually innovate. However, the tendency for large and established companies to ignore the BOP market and rather focus on existing markets gives an indication of the existence of a vulnerability that potentially disruptive innovations from the BOP will not be recognized in good time for a counter measure. This can be deduced from the fact that good management practice advocates that managers should learn and listen to their customers, therefore majority of the large existing companies continually focus on their main customer/market with sustaining innovations which leaves aspiring new entrants with an underserved BOP market to experiment with.*

This paper examines the attributes of BOP innovations that can qualify them as disruptive and the possibilities of tangible disruptive innovations arising from the bottom of the pyramid and their underlying drivers. The paper Furthermore, examines the associated impact of such innovations on the future sustainability of established large companies that are operating in the developed world, particularly those with a primary focus which is targeted towards the market at the top of the pyramid (TOP).

Additionally, with the use of a scenario planning model, the paper provides an evaluation of the possible evolution and potential sustainability impacts, that could emerge from the interplay of innovations at the two pyramidal market level and the chosen market focus of organizations – TOP or BOP. Using four scenario quadrants, the paper demonstrates the resulting possibilities from the interaction between the rate of innovations and the segment focused on by organizations with disruptive era characterizing the paradigm shift quadrant. This paper further extends the ambidextrous organizational theory to propose a recommendation to limit a catastrophic impact resulting from disruptive BOP innovations.

1. Introduction

Companies leading in their industry with huge market shares suddenly begins to lose their market position and gradually loses their leading position because a new innovation which they saw but ignored is rapidly soaking away their market and jeopardizing the projected future of their business – this is a typical disruptive innovation scenario. Disruptive Innovations by their very nature induces a reshuffling of the relative positioning of companies across sectors. They are usually seen when evolving but largely underestimated because what they offer at their inception rarely suits the demands of the mainstream market adequately. This is primarily attributed to the fact that they usually start as cheap, unstable & inferior innovations. (Christensen et al., 2001).

On a different but similar pedestal, the bottom of the pyramid (BOP) is characterized as an environment where innovation capabilities are ignored and cheap frugal innovations with inferior offerings thrive. This is typified by the fact that this market segment comprises of people with a low-income earning below 2000 dollars per year (Prahalad and Lieberthal, 1998). The BOP also has challenges and problems that foster creation of new markets (Prahalad and Hammond, 2002) that are not necessarily visible in TOP markets.

This paper is a result of exploring in more details the characteristic fit between attributes of disruptive innovation and attributes of the BOP (Baiyere et al. 2010). It also examines the potential for disruptive innovations to occur at the BOP and the impact of such occurrence on the sustainability of today's developed companies.

Research Approach

This research paper is a result of a qualitative research involving interviews, analysis of literatures, case studies, academic journals, news articles, and industry publications concerning BOP concepts, disruptive innovation tendencies and potential market drivers. 13 innovation, R&D & management professionals of top companies leading in their sectors were interviewed. 5 of the interviewees have had prior experience working or living in both TOP and BOP countries/markets.

The purview of this paper is focused on the effect of disruptive innovation from the BOPs on companies with established sustainable markets at the top of the pyramid. The paper however does not focus on the process of creating disruptive innovations and it also does not focus on the business dynamics at the TOP market. This research builds on existing research, which provides a framework for the analysis of several perceptions of the ensuing problem statement – *can disruptive innovations at the BOP impact the sustainability of companies in the developed world?*

Research questions

- Can BOP innovations be disruptive?
- Can they impact on the sustainability of today's developed companies?

2. Theoretical framework

The term BOP refers to the largest, and usually the poorest proportion of the world's population. (Prahalad 2005) According to Prahalad, this group constitutes approximately 65% of the world population and it is estimated that in the next fifty years the world population will grow from 6.2 to 9.1 billion with 90% of the population growth occurring in developing countries of today.

This strata of the pyramid is characterized by many assumptions and attributes that makes this market group to usually be ignored by most leading companies. Therefore, in defining the BOP market for the purpose of this paper it is important to understand the different perspectives with which the market is defined. According to Prahalad et al. (2002), the perspectives of most companies has been shaped by the following set of *assumptions* attributed to the BOP market. They:

- have no purchasing power and do not represent a viable market
- are not brand conscious
- are hard to reach
- are unable to use and are not interested in advanced technology

Another perspective of viewing this market after stripping of the assumptions is the BOP *reality* as observed by Prahalad (2002). They:

- constitute a large market of about 4 billion people
- are in the developing world where there are 400 cities with population of more than 1 million, of which 30% are poor
- willing to pay premium for access to goods and services
- are highly brand and value conscious
- have sophisticated technology inclination.

With this underlying assumption and attributes with which the BOP landscape is perceived, it then becomes logical for most companies to pay little attention to its inherent business value. Additionally, the existing capabilities of firms targeting the top of the pyramid do not transfer easily to the bottom of the pyramid (London & Hart, 2004). While, the other way around capabilities acquired in the base of the pyramid can have an impact by 'moving up the market' (Christensen et al., 2001).

Innovations at the Bottom of the Pyramid

A logical question that can arise when considering innovation, especially for a group like the BOP is - *can the BOP strategy be a source of innovation?* This question will be examined in this section.

Necessity – the mother of Innovation

Necessity is said to be the mother of innovation, if there is anything the BOP has in abundance it is pointedly needs (Banerjee & Duflo, 2006). Therefore if having a need is a propellant for innovation, it suffices by extension to note that the BOP is a platform for innovation. Tidd and Bessant (2009) present a diagrammatic representation of stimuli which can kick-start the process of innovation. A selected number of innovation drivers from their diagram is presented in figure 1.



Figure 1. Sources of Innovation

Examining these identified innovation sources in the light of the BOP markets can give more insight into how the BOP can indeed be a source of innovation.

Need Pull: This is basically an extension of the concept of necessity being the precursor to inventions and innovation as highlighted above. An instance is Nokia filling the lack of constant electricity by incorporating a flashlight into their phones in India. (India Knowledge@wharton,2007)

Lead Users: When users take the drivers' seat of innovation. This can be propelled by a desire for a particular individual or group in the BOP to realize that the products available does not perfectly suit their intended objectives or desires and they therefore take the initiative to modify the product and invent what suits their goals. (Hippel, 2005) This is a characteristic feature to be expected in a BOP environment where products are trickled down from the TOP without targeted modification to the BOP users.

Exploring Alternatives: Innovations in this category are born out of the need for organizations to make efforts at tailoring existing products or services to suit the conditions of the BOP market. These are innovations driven by questions like - *how do we make this cheaper?*

Watching Others: Entrepreneurs at the BOP can also be part of the innovation in this area. An example is entrepreneurs at the BOP innovating by observing how things are done at the TOP market level and creatively adapting such offerings to the BOP level. This is driven by questions like - *how can we make a waterless detergent that is suitable for use in the desert?* (Witkin, 2009)

Drivers of Innovation at the BOP

Innovation at the BOP can be influenced by a number of factors that define the populace and the environment at that position in the pyramid (Prasad & Ganvir, 2005). From the configuration of the BOP one can deduce a number of factors as possible drivers of innovation at this level. The following three BOP innovation drivers will be examined:

- Low income level
- Globalization
- Population

Low income level: To serve a market where the people live below the 2 US dollar income level, will obviously pose a challenge to the cost structure with which organizations have targeted the TOP (Pantulu, 2009). To heed Prahalads' call for multinational corporations to serve the BOP, will not only push organizations to innovate around costs but will require innovations to make products, services and distribution processes cheaper (Vachani & Smith, 2008). Considering the income level of the BOP, will be a major factor pushing for the search for efficient, lean and cost effective approaches to delivering value. This is the major driver for what is termed frugal innovation.

Globalization: As the TOP and old markets are gradually getting saturated (Hart, & Christensen, 2002), organizations have been concerned about how to extend their reach to the international marketplace and find new ones (Levitt, 1983). By extension the search for new markets and the desire for growth and stakeholder satisfaction implies that the reach of these organizations can extend to the BOP's. However, entering into the BOP market as analyzed above, will drive organizations to innovate in ways that meets the peculiar needs of serving and competing in the BOP market.

Population: With a market of a growing potential of 4 billion consumers, reaching a significant number of this group and reaping the associated benefits of economy of scale, has the tendency to push the innovation frontiers of production and distribution. Organizations planning to shift from the TOP market with fewer people, to this massive population will need to innovate and rethink their processes, in order to efficiently harness the dividends at the BOP.

Can BOP Innovations be Disruptive?

What makes an innovation disruptive? When an innovation is regarded by existing companies as unfit and unsuitable for its mainstream customers but yet disrupts the business model of such companies, it can be referred to as a disruptive innovation. According to Christensen (1997), it basically describes innovations where a product or service initially begins with simplistic applications at the bottom of a market and then gradually but relentlessly surges 'up market', and can develop with a potential to eventually displace established competitors (Christensen, 1997).

What unique attributes do BOP innovations have that can qualify them as disruptive? Firstly, disruptive innovations have a reputation of starting cheap. Innovations targeted towards the BOP should of necessity, logically stem from meeting the needs and adapting (Jaiswal, 2007) to the peculiarities of that target group. The low income attribute of BOP will demand innovations that challenges cost and offers cheap goods and services (Landrum, 2007).

Since disruptive innovation usually start with a focus on an underserved market, and the BOP fits well into this definition, this indicates that the potentials that innovations aimed at the BOP will be equally disregarded remains high. Furthermore disruptive innovations promote products and services whose impact on the market cannot be easily predicted (Christensen, Craig & Hart, 2001). This can be deduced from the fact that the large existing companies will rather focus on their main market with sustaining and incremental innovations which leaves aspiring new entrants with an unexplored BOP market to experiment with.

Furthermore, the fact that 65% of the world population spread across 300 countries constitute the BOP (Prahalad & Hammond, 2002) implies that there are different pockets from where disruptive innovations can creep from. This holds true, particularly because a reason given for the successful

penetration of disruptive innovations, is that the big companies listen and depend primarily on what their main customers says and want, therefore the more they listen to their customers the lesser they will consider the tendencies of BOP innovations to be disruptive. (Christensen, Craig & Hart, 2001). These points of fit between the concept of disruptive innovation and BOP are presented diagrammatically in figure 2.

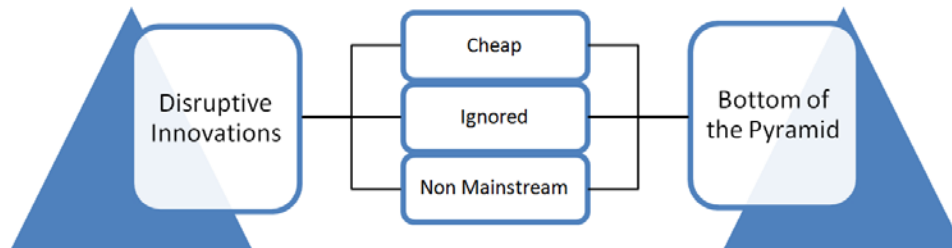


Figure 2. Similar characteristics of BOP and Disruptive Innovations

To further illustrate how innovations emerge from the bottom - up, three examples will be considered: Ryanair case (innovative cost structure), Japan case (epitome of disruptive innovation) and Tata example (typical BOP driven innovation).

Ryanair Case (Innovative Cost Structure): *“Only by continuously challenging accepted conventions and questioning costs can we continue to lower costs and fares, while improving our customer service”* – Micheal O’Leary, CEO Ryanair (2010). This statement underscores the core focus that drives the Ryanair business strategy. Ryanair has developed an innovative cost structure to operate in the air transport industry. Before the emergence of Ryanair and other low cost airlines, the costs of travelling by air was quite high (Laber, 1969) and it could be perceived as a service reserved solely for the people right at the TOP.

Where the disruption begins to occur is not just the effect of the cheap cost structure adopted by Ryanair but the associated fact that they are increasingly mounting pressures on the competition by increasing and even surpassing their quality levels (Ryanair 2010). This is apparent from the statistics in table 1.

Considering the fact that Ryanair serves majorly Europe one can arguably say it’s market is not the BOP. However, the concept of targeting the underserved holds true in the Ryanair case. Additionally, the term BOP is not representative of geographical locations. If we consider every country or region to be a pyramid, there will always be a BOP representing the bottom of that specific pyramid. Therefore, by inference Ryanair created an opportunity for students and people with low budget who would have been constrained by the cost of flying, to benefit from the advantage of air travel in Europe. By extension, this same principles are the defining characteristics of the general BOP. Therefore, it can be inferred that the Ryanair example is a snapshot of the kind of innovations that can begin from the core BOP.

Table 1. *Ryanair Customer Service Statistics (Association of European Airlines, 2009)*

Customer Service Statistics September 2010		
On time flights:	83%	
Complaints (per 2000 passenger)	0.49	
Baggage complaint (per 1000 passenger)	0.29	
Complaints answered within seven days	99%	
On time major airlines in Europe		
Airline	Ranking	%
Ryanair	1	93
Lufthansa	2	85
Air France	3	83
British airways	4	83
Major airlines with fewest lost bags		
Airline	Ranking	Baggage lost (per 1000 passengers)
Ryanair	1	0.36
Lufthansa	2	11
British Airways	3	16
TAP	4	17

Japan Case (epitome of disruptive innovation): Between the periods of 1960 to the mid 1980's the growth rate of the booming Japanese economy, has been regarded as a phenomenal stride in modern times. (Christensen et al, 2001). According to Christensen et al., this phenomenon can best be explained by the disruptive innovations that characterized the Japanese industries at that time. Their innovations created new growth opportunities in the dominant American and European industries they entered and caused existing firms to falter by allowing less-skilled and less-affluent people to perform things previously carried out only by expensive specialists. In essence, they ended up offering consumers cheaper, better, and more convenient products and services, than ever before.

Some typical examples of these innovations includes, the introduction of the Toyota Corona model which attacked the lowest tier of the American automobile market in the 1960's. The cars started as very simple but increased in reliability till they became second cars for middle income Americans. (Christensen et al. 2001)

Another example is the Sony transistor radio. The battery powered pocket radio was a disruptive technology relative to the existing vacuum tube technology. The output of this radio was burdened by static noises yet because it started with the teenagers market who were just interested in the rock and roll sounds, they could gradually move up the market until they displaced dominant radio producers relying on vacuum tubes for larger and higher quality. A similar examples that emphasizes the disruptive innovations that kick-started the phenomenal growth of Japan is the slow but cheap table photocopiers

introduced by Canon which eventually disrupted Xerox's market dominance and leading position (Christensen et al. 2001)

This case brings a number of indicators to the topic of BOP and innovations. Summarily, the Japan case does not only emphasize the point that innovations can occur from the bottom of the market to the top, but it illuminates the fact that by effective disruptive innovations, nations can change their position in the lattice of the pyramid.

Tata Case (typical BOP driven Innovation): The Tata groups car – *Nano* is a classic example of an innovative product produced with the BOP in mind, with affordability being a core element in its design, development and business model. The BOP innovation of making this car involved reducing the cost structure elements associated with producing a car, preparing to accept lower-than-standard gross margins (Wentz 2010) and aiming at selling the Nano in large volumes, essentially to the BOPs' market of first-time car buyers.

For Tata to achieve this, they had to re-engineer the process of designing, manufacturing and distributing a car to meet the BOP market. It also redefined the supplier strategy employed by opting to outsource a huge portion of the car's parts and to engage lesser number of vendors to reduce the effect of transaction costs (Wentz 2010). With this approach, Tata has been able to unfold a strategy that brings a car that would have otherwise remained a luxurious product for the TOP and the middle income earners only, to the BOP. This logically makes Nano an affordable and choice product for millions of first time car buyers in the BOP.

3. Discussion

Consequence for Today's Companies

A scenario based evaluation

From the foregoing analysis, let's re-examine our foundational question - *can Bottom of the Pyramid innovations be disruptive for companies in the developed world?* In order to deduce this, 13 innovation, R&D & management professionals of top companies leading in their sectors were interviewed. From the interviews almost all the respondents acknowledged the potential for innovations occurring at the BOP. However, about 77% of the respondents considered BOP innovations or markets to be of major significance to their market. This reveals a potential vulnerability that if a disruptive innovation should occur at the BOP it likely will be largely unnoticed at inception. Therefore considering the analysis of the various attributes of the BOP and the factors that stimulate innovations at this level, a plausible deduction is the revelation that such innovations can have disruptive impacts on companies in the developed world.

To further consolidate the foregoing analysis, a scenario model has been developed to highlight the possible evolution routes and impact of innovation at the BOP, for companies in the developed world. (See figure 3.)

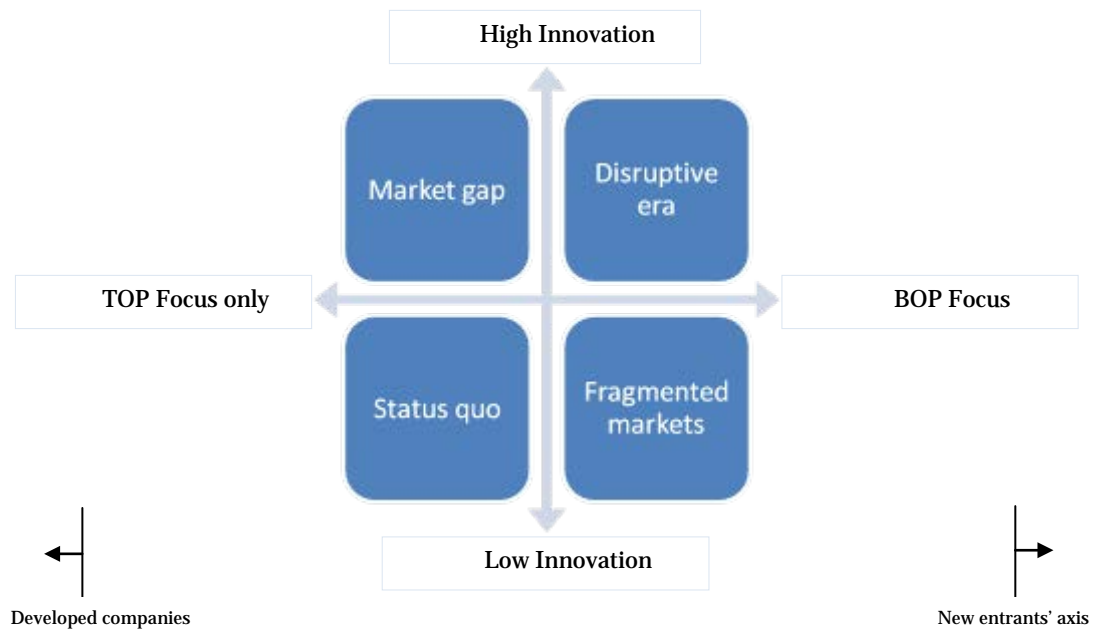


Figure 3. Scenario evaluation of innovations relative to the BOP market.

From figure 3, the two defining parameters are level of innovation and market focus of companies (TOP/BOP). Firstly, to what degree are innovations taking place? Secondly, which market group are these innovations targeted at?

The position of a company at a particular point in time on this plot, will invariably indicate the likely impact the prevailing market dynamics can have on it and its market position. Furthermore, the interaction between the innovation and the segment focused on will equally determine the status of the BOP in the future pyramidal structure.

Scenario 1 – Market Gap: In this scenario, companies are creatively innovating and their focus is primarily on the TOP market. The impact on the developed companies is a translation of innovations to business growth where added value is brought to existing customers at the TOP. This will result in a wider void between the offerings available for the TOP and the BOP such that crossing the gap will require considerable effort.

Scenario 2 – Status quo: This is the situation that occurs when there is relatively no significant innovations and the companies maintain their TOP focus. This refers to a situation where things remain the way they are without any noteworthy change in the structure of the pyramid or its effect on the developed companies.

Scenario 3 – Fragmented Market: This is a scenario whereby developed companies, BOP entrepreneurs and new entrants provide products to the BOP market without any major creative innovation of a disruptive capacity. This scenario represents a point when developed companies retain their main TOP market focus can also extend their offerings to the BOP but without any major creative change or necessary BOP related innovation. Since this scenario represents an axis with low level of innovation, BOP companies will be characterized by mediocre adaptations of TOP products for the BOP market as a means of competing with the trickling down products of the developed companies into their BOP domain. Thereby resulting in a TOP market dominated by the developed companies and a non disruptive BOP market with BOP-focused small companies.

Scenario 4 – Disruptive Era: This is the scenario that represents a *paradigm shift* in the interplay between developed companies focusing at the TOP and the others - usually new entrants (Christensen, 2007) focusing on the BOP. In this scenario, companies in the developed world remain stuck to creating sustaining innovations for their customers while the innovations from the new entrants emerging from the BOP disrupts their market balance. This is the scenario with which developed companies need to pay particular attention to because the impact of disruptive innovations can spell catastrophe for top organizations in disrupted TOP markets and for some it might just mean a fall from their esteemed market position.

Recommendation

The sporadic nature of the occurrence of disruptive innovations makes it difficult for organizations to have a routine process of handling them (Bower & Christensen, 1995). Furthermore, the tendency exists that innovations targeting the BOP will increase, however developed companies of today focusing on the TOP will have good reasons to maintain just their TOP focus, because good management practice advocates that managers listen to and follow their customers (Christensen & Anthony, 2007), hence they will likely not see potential disruptive innovations coming from the BOP before it is too late.

Following the arguments presented for adopting an ambidextrous organization (O' Reilly, 2004) in literatures, a recommendation to curtail a catastrophic effect of BOP disruptions on developed companies is to adopt an *ambidextrous approach* (Leifer, et al. 2000). The ambidextrous approach offers the advantage of looking at the future without losing focus of the present (Daniel, 2006). With this approach organizations can leverage BOP as a catalyst for innovation by dedicating resources for BOP related innovations and simultaneously observe trends (Christensen & Anthony, 2007) in order react accordingly to emerging disruptive signals (Christensen, 1997).

4. Conclusion

With the observed similarities and fit between the characteristics of disruptive innovations and BOP, it becomes apparent that there exists a tendency that disruptive innovations can be initiated by organizations focusing on this sector of the market. A general phenomenon with disruptive innovations is their potential to reshuffle the positioning of companies whenever they occur. In many cases most leading companies in an industry affected by disruptive innovation either falter or cease to exist completely. This has brought attention to this form of innovations, however, due to the little significance accorded to the BOP market segment it reveals the potential for disruptive innovations occurring at this level to have a resounding impact on companies affected.

Additionally, existing capabilities of companies focused on the TOP do not transfer easily to the BOP (London & Hart, 2004). However, capabilities acquired at the BOP can move up the market which can also have implications for the firms in the developed world, as new techniques and disruptive offerings have the potential to become mainstream.

A scenario planning evaluation of this concept based on the interaction between rate of innovation and pyramidal market focus gives an indication that a disruptive era is a likely occurrence when there is high level of innovation by organizations dedicating attention to the BOP market. In addition to adopting an ambidextrous organizational approach, exploring opportunities of being active in BOP

markets could also be considered by firms as a possibility to detect early innovations with disruptive tendency in their industry.

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IMPLEMENTATION OF TOTAL RESPONSIBILITY MANAGEMENT INTO CORPORATE STRATEGY

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ABSTRACT – *This contribution reports about relationship and potential synergies between the total quality management (TQM) and total responsibility management (TRM) as well as corporate citizenship. TRM principles and standards reflect the raising public expectations about corporate social responsibility. Many companies develop TRM as requisitely holistically and hence successfully manage their responsibilities toward their stakeholders and natural environment. The evolution and implementation of TRM in companies includes three main components/approaches: inspiration/vision, integration and improvement/innovation. The improvement/innovation elements of TRM create a significant demand for companies to broaden measuring of their performance. TRM indicators focus on stakeholders (together with triple-bottom-lines) of economic, social and environment issues ('cost-benefit' approach). Gorenje Group represents a successful case of implementation of TRM into corporate strategy (including sustainable indicators). The synergies also lead (socially) responsible companies to long-term competitiveness by contributing to requisitely holistic management of (innovative-responsible) enterprises/companies. CSR and sustainability could be promoted through transparency, good governance, concern for the environment and good relations with company's stakeholders. Morally proactive leadership is critical for successful TRM and corporate citizenship. The proactive companies focus on the importance of CSR and its management inside and outside the global company (case Gorenje Group). Introduction of TRM may hence be a management innovation.*

Key words: *corporate social responsibility (CSR), total quality management (TQM), total responsibility management (TRM), corporate citizenship (CC), ecology, sustainable indicators, leadership, competitiveness, Gorenje Group*

1. Introduction

Total Quality management is given in modern companies – a competitive imperative. Holistic CSR is continual company's commitment to ethical behavior, economic development, and improvement of the life quality of employees, their families, the local community, and society in general. In the 21st century, corporate citizenship may become the standard expectations for global business enterprises. Researches suggest that CSR under certain conditions can stimulate innovation, investment or trade and consequently also competitiveness. As Porter & Kramer (2006) state "corporations are neither responsible for the world's problem, nor do they have the resources to solve them all. Each company can identify the particular set of societal problems that it is best equipped to help resolve and form, which it can gain the greatest competitive benefit from." During the last decade growing numbers of companies worldwide acknowledged the importance of CSR in doing business (Cramer, 2003). Today CSR is one of the most important items on the corporate boardroom agenda for significant number of companies worldwide (Grayson & Hodger, 2004). The challenges of sustainability are now being expanded in the increasing CSR-related expectations and changing consumer's behavior as well as accountability and being more active and involved in the civil society. The goal of this paper is to research the relationship and potential synergies between the total quality management (TQM), total responsibility management (TRM), corporate citizenship (CC), strategic CSR as well as CSR as emerging systems from the social to environmental responsibility and sustainable indicators and their implementation – in one of the biggest producer of domestic appliances in Slovenia and the European Union.

2. Strategic corporate social responsibility

At this point, it needs to be emphasized that substantial business benefits can be achieved through conducting strategic firm activities (Alperson, 1995). Therefore it is important to highlight the business-related benefits gained through implementing and executing strategic CSR activities (Bhattacharyya, 2009, 86 - 89). First of all, it will help companies in following a generic strategy. Basically, it is argued that cost leadership or differentiation can be achieved through the effective use of strategic CSR activities (Porter & Kramer, 2006, 4-16). In this connection several authors (Day & Wensley, 1988; Hunt, 2000; Miles & Covin, 2000; Karna et al., 2003; Crawford & Scaletta, 2005; Porter & Kramer, 2006; cited in Bhattacharyya, 2009, 86) stress in their works that on the one hand CSR can contribute to the achievement of cost leadership, since companies can benefit from the above-mentioned advantages and thus are likely to gain a favourable cost advantage. On the other hand, the image of a socially responsible and environmentally sensitive or conscious organization can be realized through strategic CSR.

CSR is likely to contribute to the development of new business opportunities (Bhattacharyya, 2009, 87). Porter & Kramer (2006, 13) add that by engaging in strategic CSR, new product offerings are likely to emerge, which are in turn benefiting both, social and environmental issues in addition to a company's long-term competitiveness. In a similar vein, Brugmann & Prahalad (2007, 1–13) emphasized that companies engage and interact with a number of different stakeholders as well as with communities when implementing strategic CSR activities. At the same time organizations have begun to experiment with new business models due to the help and influence of CSR. CSR strategy will help a firm to manage

stakeholder-related risks better Bonini et al. (2006, 20-32). Basically, in this connection Smith (2005, 57-65) points out that social issues mismanagement, respectively ignoring social risks can lead to protests by social institutions against companies as well as to a loss of the firm's reputation in society (Bhattacharya, 2009, 88). Furthermore, in addition to the mentioned benefits Heslin and Ochoa (2008, 128-131) point out that growth in market share, increased organizational learning, retention of deeply engaged employees, support from external stakeholders as well as favourable relationships with investors can be the result of executing strategic CSR.

First of all, increased sales of both, premium products and services can result from a company's intense CSR efforts, because consumers are increasingly looking for these efforts, as already mentioned in previous chapters. Secondly, companies can learn through conducting strategic CSR, like for example through projects in which they invest. The knowledge accumulated can be subsequently used to further develop a firm's core competencies or to drive new innovations, in addition to contributing to the improvement of social and environmental conditions. (Heslin & Ochoa, 2008, 128) Thirdly, Heslin & Ochoa (2008, 129) state that more and more employees are looking for socially responsible companies to work for. Therefore CSR, especially strategic CSR, represents a powerful instrument in order to motivate and retain committed and engaged employees.

The survival and prosperity of organizations is highly influenced by various external stakeholders and the credibility of companies is increasingly measured by the degree of a firm's CSR involvement (Heslin & Ochoa, 2008, 130). There are a number of benefits that can be achieved through a company's commitment to CSR.

3. Corporate Citizenship and Total responsibility Management in practice

Corporate Citizenship - The metamorphosis of capitalism lies at the very heart of the discussions about CSR, and more recently, corporate citizenship that has abed and flowed throughout most of the 20th century. As more and more pressure is put on capitalism to perform as basically the only major economic system the world now has left, the focus on the social and environmental impact on that system will inevitably increase. Holistic corporate citizenship is best viewed, not as a program of activities but as a holistic system of organizational behavior affecting every level and aspect of an organization's policies and practices (Eklington, 1997, 258). Stories of corporate citizenship practice about (see McIntosh et al. 1998; Tichy et al. 1999); theories of corporate citizenship are in the making (Altman & Davenport 1998; Altman & Vivader-Choen, 1995; Davenport 1998, Davenport et al. 1999; Waddock 1999 and 2001; Wood & Logsdon 1999). However, as far as we are aware, there is as yet no substantial research bridge between theory and practice, no assessment of the gap between desired and current states of corporate citizenship. Three attributes are presented, which indicate the good corporate citizenship: ethical business behavior, stakeholder commitment and environmental commitment. To support these three attributes, participants identified 20 principles of corporate citizenship as criteria for guiding and assessing an organization's performance (Davenport, 1998): Ethical business behavior, stakeholder commitment, community commitment, consumer commitment, employee commitment, investor commitment, supplier commitment, environmental commitment.

Responsibility management - The research into CSR, carried out over the last 30 years has mainly been related to the analysis of value creation (Clarkson, 1995; Harrison and Feeman, 1999;

Waddock and Graves, 1997). Nevertheless, this economic motivation, still of great relevance, does not seem to be enough to justify the growing tendency to propose socially responsible behavior in companies. Approaches to this question can be made from various starting points. The first of these is the factors that explain why companies reveal or divulge information of a social nature (Stanwick and Stanwick, 2006), and lastly, applicable in wider sense, a variety of principles, processes, policies, programs and observable results relative to the company's relationship with society, which uses for its measurement social indices that may be provided by social rating institutions, or ad hoc indices drawn up by the researchers themselves (Johnson and Greening, 1999; Mahoney and Thorne, 2005). To the present, there have been few empirical studies on the explicatory factors of corporate social behavior, and these have been limited to the United States and Europe (Maignan and Ralston (2002).

The neo-institutional theory suggests that organizations and their strategies are strongly influenced by the institutional characteristics in which they operate and by the legacy reflected by the culture, history and policy of a specific country or region (Doh and Guay, 2006; Maignan and Ferrell, 2003; Matten and Moon, 2008, Wisser & Tolhurst, 2010). Furthermore, Welford (2005) states that generally CSR is more active in Europe than in the United States or Canada, mainly in the North European Countries. The results obtained in research (Sotorrio and Sanchez, 2008) show that there are significant differences in the social behavior between highly reputed European and North American companies (Aguilera et al., 2006; Matten and Moon, 2008, Dietz & Stern, 2008; Louche et al., 2010).

Implementation of Total responsibility Management (TRM) into strategy - The next major component of TRM is integration. TRM integrates the company's inspirational vision into its strategies, its employee relationships and practices, and the numerous management systems that support company strategies. TRM, using continual improvement tools creates feedback loops that foster innovation and improvement in management systems. Key performance indicators, or a measurement system that assesses how well the company is performing along at least the triple bottom line of economic, social, and environment is an important element of the TRM framework; so are transparency and accountability for results. TRM in brief means (Waddock & Bodwell, 2007): inspiration, integration, innovation, and plus indicators. In analogy with quality management TRM follows the traditional process sequence embedded in quality systems in their implementation – plan, do check, act – a process that is embedded in the corporate accountability management system called SA8000 (Social Accountability 8000), which primarily focuses on implementation of labor standards but can be extended to TRM (Strum et al. 2000). The plan-do-check-act sequence provides a process for continual improvement, which is needed to ensure not only that responsibility management is in place, but also that the company is on a path of continual improvement. TRM is very similar to TQM, where top-management and leadership commitment to customers is a fundamental first step (Gorenak & Bobek, 2010).

Employees in quality-oriented culture instinctively act as a team. Organizations where focuses on customers, continuous improvement, and teamwork are taken for granted have a good chance of attaining the total quality. The criteria are built upon a set of “core values and concepts” (Evans, 2007): visionary leadership, customer-driven excellence, organizational and personal learning, valuing employees and partners, agility, focus on the future, managing for innovation, management by facts, CSR, focus on results and creating value and systems perspective. The comparison of core values and concepts in TQM/Baldrige Award and TRM are presented in Table 1.

Table 4. Comparison of core values and concepts in TQM/Baldrige Award and TRM

Source: Adopted, Waddock and Bodwell (2007, 57-59)

TQM/Baldrige award core values/concepts	TRM core values / concepts
Visionary leadership	Visionary and committed leadership
Customer-driven excellence	Stakeholder-driven excellence and responsible practices
Organizational and personal learning	Organizational and personal learning through dialogue and mutual engagement with relevant stakeholders
Valuing employees and partners	Valuing employees, partners, other stakeholders
Agility	Agility and responsiveness
Focus on the future (short and long term)	Focus on the future (short and long term)
Managing for innovation	Managing for responsibility and improvement
Management by fact	Management by fact, transparency, accountability
Public responsibility and citizenship	Public responsibility and citizenship
Focus on results and creating value	Focus on positive results, impacts and value-added for stakeholders with responsible ecological practices

At the company’s level, sustainable development strategy should be “fostered by a strong sense of social environmental purpose”; it implies a commitment to a triple bottom line that includes profitability, environmental and social goals (Fowler and Hope, 2007). The important work of Collins & Porras (1997) highlights how a well-articulated vision can contribute to company’s long-term success. A necessary condition is having a clear vision about CSR from the top management and well-articulated guiding core values that support the vision.

Leadership commitment - Leaders and managers in company play a crucial role in developing vision and values. One cannot be a moral leader without first being a leader. Moral leaders possess a number of important qualities. Perhaps these qualities could be referred to as ‘habits’, which distinguish them from immoral or amoral leaders. Ethical and moral leaders have a passion to do the right thing (Fassin et al., 2010). They are appropriately motivated. They are morally proactive – they take the initiatives and are on the cutting edge of doing the right thing. They are stakeholders inclusive. They adopt and use the stakeholder model of the organization. They strive to be sure that all relevant stakeholders are taken into consideration. They have a strong ethical character and an obsession for fairness. Moral leaders are principled decision-makers and they know how to integrate ethical wisdom with management wisdom in all that they do. Adopting a TRM approach means systematically changing the entire company, ensuring that vision and values are integrated into all company’s strategies and operating practices; it also requires the top management involvement. Leaders, wherever they are in the organization, but particularly in the top management, need to take a long-term perspective, make a public commitment, communicate the commitment, be a role model for the company’s values, to integrate vision and values into strategies and practices, and support change (Waddock & Bodwell, 2007). Leading companies are finding that new strategic and organizational skills are required to integrate stakeholder considerations into the value delivery capability of their organizations. The eight disciplines of sustainable value are integrated into a management process that executives can use in their

organizations to discover and create sustainable value in a step-by-step approach (Laszlo, 2008, 135-136).

Stakeholder engagement - The proactive stance is the best in this attempt to anticipate and hence respond to problems before they arise. Many companies find that two-way communication or what is called stakeholder engagement can help to provide better information about possible problems and better prepare the company for issues. The next important task is to identify the relevant stakeholders. Most companies would acknowledge the importance of a certain set of stakeholders, called primary and secondary stakeholders (see e.g. Clarkson 1995; Waddock 2006). Integrating responsibility management into the organization is contingent on many factors unique to each situation. What is clear is that responsibility management approaches must be systemic, i.e. holistic, if they are to be effective. In addition, the quality movement articulated a set of important principles, by which organizations could begin to move their practices towards higher levels of quality as well as continual improvement (Gorenak & Bobek, 2010). Furthermore, TRM criteria for performance excellence are presented as roadmap for companies to follow when they are implementing TRM (Waddock & Bodwell (2007, 130-131).

Indicators and ISO 26000 - The improvement and innovation elements of TRM create a significant demand for companies to broaden how they measure performance. To measure responsibility, new indicators need to be added to financial and quality management systems, in what we call 'plus indicators'. Indicators for TRM focus on stakeholders, and on the triple bottom lines of economic, societal and environment issues. One of the most notable approaches is that of the Global Reporting Initiative (GRI), a multi-stakeholder initiative that aims to devise and implement globally accepted responsibility and sustainability reporting guidelines that are comparable across companies operating in different industries, much as generally accepted accounting principles are standardized. Knez-Riedl & Mulej (2008, 103) presented some examples of the cost/benefit alternatives in business alternatives in business (directly visible and costs-indirect, maybe hidden costs). Social responsibility (ISO 26000, 2010) is a new reaction to the problems of one-sidedness. In ISO 26000 SR differs from the European Union's and UNO's definition of social responsibility (passed a decade ago) by including one more topic of crucial importance and by linking all seven listed contents with two crucial concepts of systems theory as the science about attainment of holism instead of one-sidedness and related consequences holism and interdependence. The Implications of ISO 26000, is designed to guide both quality professionals and business leaders as they maximize the role of the quality professional in SR initiatives. The new ISO 26000 standard offers a definition of what it means to be a socially responsible organization and why companies should adopt the premises of the standard. Thus, SR is not only reinforcing systemic behavior; it is also requiring innovation as process for systemic, i.e. (requisitely) holistic (RH) behavior to become innovation as outcome. The seven contents of ISO 26000 include: (1) Governance and management of organizations; (2) Human rights (as the newly added topic); (3) Labor practices; (4) Environment; (5) Fair business practices, (6) Consumer issues, and (7) Community involvement and development. SR (without its limitation to charity) is a human attribute making humans and their organizations more conscious of interdependence, hence practice more ethics of interdependence, and therefore attaining more, or even requisite, holism.

4. Responsible competitiveness

To understand competitiveness, the starting point must be the sources of a nation's prosperity. A nation's standard of living is determined by the productivity of its economy, which is measured by the value of goods and services produced per unit of the nation's human, capital, and natural resources (Cornelius and Porter, 2002). Businesses can compete effectively across the responsibility spectrum, spanning from investment in environmentally friendly technology and raising productivity by improving their employees' work-life balance, through to cutting corners on environment and labor standards and engaging in corrupt relationships with governments. Public policies to amplify corporate responsibility practices need to be, and indeed are being, formulated in the context of this complexity at an international level, and also at regional, national, and even community levels: redefining our understanding of 'responsible competitiveness'; national, regional and sector analysis; standards, tools and competitiveness; responsible competitiveness, winners and losers; redefining competitiveness measures (Cruz & Boehe, 2010; Abländer, 2011). Measuring progress on country's progress on sustainable development strategy includes a wide set of indicators, additional and improved ways of measuring progress, strategic assessment of performance and progress (Porter, 1998; Porter & Kramer, 2006; Zadek, 2004, 2006; White et al, 2006;).

5. Gorenje Group - from Total Responsibility Management to Corporate Citizenship

Problem definition

Problem - The main researches on CSR and competitiveness have not included synergies between TQM, TRM, including sustainable indicators and CC into innovative and holistic corporation strategies in internationally successful Slovenian company – case Gorenje Group.

Hypothesis: Strategic CSR and implementation of the holistic and innovative TRM into corporate strategy are elements of successful CSR, CC and sustainable development lead company to sustainable development and long-term responsible competitiveness.

Methodology – deep interview with CSR-manager in the Gorenje Group.

Research questions - Recognize that TQM, TRM, CSR and CC is more than CSR and is not simply project-based: it is about three domains – the organization itself, the core business and the community in which the organization operates. The research questions are oriented to innovative and holistic TRM including leadership commitment, corporate strategy, indicators, expected outcomes, responsible competitiveness and corporate citizenship, as well as sustainable behavior of the consumers of their products including their support.

Research findings in general

Gorenje Group wider values, leadership principles and policies are supplemented by the Gorenje Sustainable Development Policy, which lays down their sustainability strategy. The Gorenje Group has

undertaken to pursue a sustainable and value-oriented business policy, in part through their commitment to the Global Responsible Care Initiative. The Gorenje Group is aware of its responsibility for its activities, which have an impact on people as well as on closer and wider surroundings, including the natural environment; therefore its approach to the CSR is a planned and responsible one. Group-wide control of this task is handled by the Gorenje Corporate Sustainability Board, the most important committee for sustainability management at the Group level. The Gorenje Corporate Sustainability Board consists of the members of the management boards of the subgroups responsible for ecology and technology and the heads of the Corporate Center departments for Corporate Human Resources & Organization, Communications and Environment & Sustainability. Chaired by the Group Management Board member responsible for Innovation, Technology and Environment, this body meets regularly to jointly establish the sustainability strategy and objectives, to adopt Group sustainability-related directives and to decide on key initiatives. A corner stone in the implementation of these decisions is the Environment & Sustainability Department, The subgroups and service companies have established effective management systems for health, safety, environmental protection and quality (HSEQ). Rules governing health protection and workplace safety are particularly important and have thus been adapted. The Gorenje Group is aware of the responsibility for its activities with impact on people as well as on closer and wider surroundings, including the natural environment; therefore its approach to CSR is a planned and responsible one. CSR in Gorenje Group incorporates: (1) Responsibility to employees (concern for education and training of employees, concern for young and promising staff, development of human resources, health-care for employees, assurance of suitable employment to disabled persons and communications with employees); (2) Responsibility to users of products and services (assurance of product safety and assurance of environmental friendly); (3) Responsibility to close and wide social environment and (4) Responsibility to the natural environment.

Eco Family initiative – To commemorate the Earth day, Gorenje presented for the first time the Eco Family initiative to the public. The aim of the initiative is to motivate individuals to change their wasteful habits, to introduce energy-efficient technology in their homes, and to seek alternative options. By establishing the Eco Family initiative, Gorenje is extending the framework of thinking about the agents of efforts for a cleaner environment; in addition to asking what I can do as an individual or employee, it seeks to answer how we as society can contribute. Two books entitled Ecofamily – Environmentally Friendly Operation in Order to Preserve the Planet and Ecofamily – Help the Planet with the Informed Behavior, have been published within the initiative of the Eco Family.

Basically, the case of Gorenje Group is an outstanding example, which shows very clearly that CSR entails many opportunities to pioneer innovations, such as new (innovative) product offerings. Innovation has provided the company with a competitive advantage, in terms of a differentiation strategy, since it has given the company a unique position in the market, in addition to the fact that it has led to a number of environmental benefits. Furthermore, the technology of Gorenje, implying that such innovations are likely to lead to standards in the entire industry. This example perfectly shows the power of strategic CSR.

6. Discussion and Conclusions

Nowadays participants in stakeholder partnerships come together specifically to achieve social benefits through joint action. This is accomplished in part by enabling individual partners to pursue their own interests, which may include the direct or indirect commercial interest of participating companies, as well as the interests of other partners. New social partnership can be effective at both the local and the strategic levels, but will not necessarily be so. Governance structures are changing fundamentally at all levels of society – locally, nationally and globally. The way this transition develops will have critical implications for the ability of communities and countries to address the challenges of economic competitiveness, social cohesion and sustainable development. In the final analysis, TRM and CC is unattainable without moral leadership. CSR is included in the corporation strategies. Long-term competitive advantages are expected. The relationship and potential synergies between the TRM its measurement (sustainable indicators) and CC including responsible consumers lead companies to long-term competitiveness. Gorenje Group typically makes an effort to provide products that guarantee the satisfaction of customers as well as other stakeholder and meets their expectations. The result of this study presents a positive contribution to the progress and development of CSR in Gorenje Group, to discussion and debates on CSR, and conformation furtherance of theories important in studying CSR, TRM and sustainable development and its measurement. Theories and discussions on CSR and sustainability are still evolving. As shown in this study, the responses in the case company (Gorenje Group) are positive and substantiated by its programs directly addressing how to develop and improve CSR by implementation of CC, TRM and into corporate strategies. This underscores the need for better measurement models (indicators) of CC, sustainable development that capture and estimate clearly the effects of a company's actions on its stakeholders (direct and indirect). The synergies between CC and responsible consumption also lead CSR-enterprises to long-term competitive advantages by contributing to requisitely holistic management of innovative companies. The aim – to highlight the characteristic features of Gorenje Group CSR, TRM, CC and compare them to other researches (theoretical and empirical) with available empirical published studies – is achieved. Finally, this case adds to the mounting evidence that CSR, TRM and CC in general, has created a new dimension in managing sustainability at the corporate level.

Future research could focus on companies following low-cost (and cost-benefit) strategies, as the strategic CSR and CC imperatives should vary with a different responsible competitive positioning. As the case study analyzed in this paper was exploratory, future research could concentrate in a survey of different companies within a single industry or region in order to provide further valuable insights into how sustainable business practices are incorporated into company (holistic) strategy. Further research might also analyze the moderating role of consumer personality traits such as innovativeness, that may also impact corporate character and contribute to consumer-company identification in dimensions other than those generated by corporate citizenship, as well as CSR, initiatives and may benefit the development of a scale that captures the entire domain of corporate citizenship and CSR. We have to understand innovative and holistic TRM and corporate citizenship not as a mere public relations activity, but as an important device of new governance structures on an international and global level. We need a global dialogue between politicians, business and research institutions about 'best practice'

and ways to enhance and effectively coordinate CSR activities. Introduction of TRM may hence be a management innovation.

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STAKEHOLDERS AND CORPORATE SOCIAL RESPONSIBILITY IN CORPORATE RESPONSIBILITY DISCLOSURE

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ABSTRACT – *Corporate social responsibility (CSR) consists of the responsibility of economic, social and environmental issues. Companies collect CSR data from the various parts of the company and use it e.g. to publish different types of reports, magazines and webpages. The results presented here are part of an on-going project that focuses on the feasibility and utilisation of CSR information in the anticipatory decision making. Three Finnish companies are used as case studies. The material of this analysis is the sustainability webpages, CSR reports and the press releases. Content analysis is used to find out which stakeholders the case companies mention and under which part of the CSR they are mentioned. Several different stakeholders are mentioned, most often customers, cooperative companies and employees. Top ten stakeholders differ some when comparing the areas of CSR and disclosure type. In the next phase of the project, the analysis will be widened to annual reports, CSR policies and stakeholder magazines. Also, several interviews will be made in order to evaluate the process of dissemination of CSR information inside and outside the company.*

1. Introduction and Background

Corporate Social Responsibility

Corporate social responsibility (CSR) is an important part of the management of companies. However, what is included in the definition varies between companies and business sectors. Usually, CSR consists of company's responsibility 1) of its actions, 2) beyond the legislative requirements and 3) towards to its stakeholders (Vehkaperä 2005). Company's responsibility of its actions is usually understood as responsibility of company's economic, social and environmental impacts (Vehkaperä 2005, Elkington 1999, Kujala & Kuvaja 2002, Wilenius 2005, Teollisuuden ja työnantajien keskusliitto 2001). The economic responsibility covers aspects such as responding to the owners' profit expectations and producing welfare to the society (Teollisuuden ja työnantajien keskusliitto 2001). As, the environmental responsibility is the responsibility of the natural environment (Teollisuuden ja työnantajien keskusliitto 2001, Niskala & Tarna 2003). Social responsibility covers the aspects of the social relationships between

the company and its stakeholders. Often here the stakeholders of employees, customers and subcontractors and the surrounding society in general are mentioned (Teollisuuden ja työnantajien keskusliitto 2001, Niskala & Tarna 2003, Zwetsloot & Starren 2004).

Corporate Responsibility Disclosure

As a part of CSR work, companies collect CSR data and use it to publish different types of publications which are targeted either to internal or external or both groups of stakeholders. Zéghal and Ahmed (1990) list staff newspapers, press releases, paid ads and company brochures as ways of disclosing CSR information. CSR disclosure means the information of environmental and social impacts and interactions with the economic performance (Ball et al. 2006). Gray et al. (2001) see CSR disclosure as covering the information of company's activities, aspirations and public image of environmental and social issues.

An important part of CSR disclosure is a CSR report. A GRI (2006) definition of a CSR report is that the report should offer a balanced picture of company's sustainability performance. Niskala et al. (2009) sees a CSR report as an effective way to report the actions, results, risks and possibilities of CSR to the stakeholders.

Companies have several reasons to publish information of the CSR work. O'Dwyer et al. (2005) say that companies are "considered to have an obligation to provide information on social and environmental impacts" to stakeholders. The aim of CSR disclosure is to "anticipate or avoid social pressure" (Zeghal & Ahmed 1990). The disclosure should be accounting to the society (SustainAbility 2006). However, it is often used to improve company's image and promote public relations (Williams & Ho Wern Pei 1999) instead of really demonstrating company's concern of CSR issues (Tilt 2007). Niskala et al. (2009) see that the disclosure helps to control company's image risks. The disclosure is a way to start a dialogue with the stakeholders (Tregidga & Milne 2006).

Stakeholders

As with the concept of CSR, also "a stakeholder" can be defined many ways. The most common and used definition is one of Freeman's: A stakeholder is a person or group of persons who are influenced by the company or who are influencing the company (Freeman 1984). Companies operate in cooperation with its stakeholders (Freeman 1984). Stakeholders provide the stakes (e.g. money, knowledge, work, power or goods) that companies need to operate (Näsi 1995, Juholin 2003, Kankkunen & Matikainen 1995). However, stakeholders have claims for companies as well. They expect salaries, products, etc. in return but more often also responsibility and information of company's performance.

Quite naturally the significance of stakeholders varies between companies and also during the time. Companies can prioritize the stakeholders. Primary stakeholders are such that without whose support the company cannot function (Clarkson 1995, Schaltegger 1997, Juholin 2004). They are employees, owners, customers, suppliers, investors, directors and the local community (Niskala & Tarna 2003, Clarkson 1995, Juholin 2004, Freeman 2004). Secondary stakeholders, on the other hand, are the rest, such as media and civic organizations (Niskala & Tarna 2003, Clarkson 1995, Niskala & Näsi 1995).

Customers, employees and authorities are mentioned most often as the important stakeholders of the company¹.

The Aim of the Paper

The aim of the paper is to describe the corporate responsibility disclosure of the case companies from the point of view of the stakeholders. The stakeholders are here understood as a person or a group of persons or an organisation or a group of organisations that are mentioned in the corporate disclosure. CSR here is company's responsibility of its economic, social and environmental actions towards the stakeholders.

2. Material and Methods

Project on the Feasibility and Utilisation of CSR Information in the Anticipatory Decision Making

The results presented here are part of an on-going project that focuses on the feasibility and utilisation of CSR information in the anticipatory decision making. Project is a cooperative project between the universities of Turku and Jyväskylä. Three Finnish companies are used as case studies. The CSR disclosure (annual reports, CSR reports, policies, media releases, stakeholder magazines and sustainability webpages), will be content analysed in the project. The content analysis will focus on the stakeholders and themes of CSR mentioned in the disclosure. Also, several interviews will be made in order to evaluate the process of dissemination of CSR information inside and outside the company. Inside the companies, persons responsible for CSR, employees and managers will be interviewed. The views of the external stakeholders will be gathered with surveys and interviews.

Case Companies

Three Finnish companies are used as case studies. The case companies are described here briefly. Company A is a company from the transportation sector. It was established in 1923. In 2010, the turnover was 2 000 Million Euros and it employed about 7600 employees. The biggest shareholder of the company is the State of Finland, other shareholders being the insurances companies, other companies and private persons. About 20% of the shares are owned by foreigners. Company B is a member of the energy sector. It was established in 1998 (from a merger). The turnover was 6300 Million Euros in 2010. Company B employed 10600 employees in 2010. The biggest shareholder of the company is the State of Finland. Other shareholders are insurances companies, other companies and private

¹ Based on the small review of literature: Important stakeholders are listed e.g. in Beaucham and Bowie 2004, Belz and Strannegård 1997, Carrol 1995, Delmas and Toffel 2004, Elkington 1999, Hopkins 2004, Juholin 2004, Keskuskauppakamari 2003, Khanna and Anton 2002, Kujala and Kuvaja 2002, Könnölä and Rinne 2001, Laurila 1995, Lovio 2004, Messelbeck and Whaley 1999, Mikkilä et al. 2005, Niskala and Tarna 2003, Sheehan and Ritcie 2005, Tammilehto 2003, Ytterhus 1997, Synnestvedt and Ytterhus 1996 and Zwetsloot & Starren 2004

persons. About 30% of the shares are owned by foreigners. Company C is from the financial sector. It was established in 1982 (from a merger). Its turnover was 1300 Million Euros in 2009. In 2010, it employed 3200 employees. Company C is owned by its customers.

Content Analysis of Corporate Responsibility Disclosure

The material of this analysis are the sustainability webpages (autumn 2010), CSR reports (year 2009) and the press releases (year 2009) of the case companies. The width of the material is described in the Table 1. Companies differ in the amount of material published of CSR. Company A publishes the longest CSR report. Company B's CSR report is the shortest because it is published as a part of the annual report. Company B's sustainability webpages are by far the most comprehensive among the case companies. The amount of press releases published was the lowest in the Company C.

Table 1. Description of the original material analysed

	Company A	Company B	Company C
CSR report	62 pages	12 pages (published as part of the annual report)	48 pages
Sustainability webpages	23 webpages	87 webpages	16 webpages
Press releases	134 pieces	138 pieces	63 pieces

The aim of the content analysis is to find out which stakeholders the case companies mention and under which part of the CSR the stakeholders are mentioned. The material is analysed by phrases and the analysis is done in Finnish. In the first phase of the content analysis, the sentences that mention stakeholders are sought from the original material. In the second phase, the sentences were coded with mentioned stakeholders and the area of CSR which the sentence addresses. In the first coding of the stakeholders, the actual term used in the sentences was used as the code. Later the stakeholder codes were grouped into larger groups.

3. Results

After the first coding, 998 different stakeholders emerged from the material. Most of these were mentioned only once in the material. The most often mentioned stakeholders were customer, personnel, passenger and corporate customer. After grouping the stakeholders into bigger groups the most often mentioned were customers, cooperative companies and employees.

In the Tables 2–4, the analysis of the stakeholders is combined with the area CSR and the type of disclosure. These tables list the ten most commonly mentioned stakeholders. In general, cooperative companies, customers and non-governmental organisations were the most often mentioned stakeholders. Three to four of the most commonly mentioned stakeholders were rather often mentioned but the rest rather seldom. In the following, content of the tables are highlighted. First, the top four stakeholders are listed. Second, the differences in the top ten stakeholder lists are presented.

The top ten stakeholders in economic, environmental and social responsibility are gathered in the Table 2. There were only slight differences in the top four stakeholders between the areas of CSR: In economic responsibility, the top four stakeholders were customers, cooperative companies, companies from own sector and employees. In environmental responsibility, they were cooperative companies, non-governmental organisations, customers and companies from own sector and in social responsibility, employees, customers, non-governmental organisations and cooperative companies. The variations were bigger in the top ten lists. Investors were only mentioned under economic responsibility. Authorities and environmental organisations were only mentioned in environmental responsibility and directors, then again, only mentioned in social responsibility. Internal working groups and passengers were not mentioned under environmental responsibility.

Table 2. The top ten stakeholders in economic, environmental and social responsibility

	Economic responsibility	Environmental responsibility	Social responsibility
Authorities	-	21	-
Board of directors	62	11	41
Companies of own sector	121	78	136
Cooperative companies	282	159	198
Customers	283	99	275
Directors	-	-	54
Employees	117	46	372
Environmental organisation	-	38	-
EU	-	30	-
Internal working groups	30	-	55
Investors	33	-	-
Non-governmental organisations	98	106	202
Passengers	43	-	66
Society	44	30	51

- = not in the top ten

The top four is bolded.

The top ten stakeholders by the disclosure type are presented in the Table 3. Once again, no big differences arose from the top four stakeholders. The most commonly mentioned stakeholders in the CSR reports were employees, customers, non-governmental organisations and cooperative companies. In the sustainability webpages, they were customers, employees, cooperative companies and non-governmental organisations. In the press releases, most commonly mentioned were cooperative companies, customers, companies of own sector and employees. Superiors were only mentioned in the CSR reports. Environmental organisations, EU and suppliers were only mentioned in the sustainability webpages. Authorities, Finns and passengers were only mentioned in the press releases. Internal

working groups and board of directors are not mentioned in the sustainability webpages. Society is not mentioned in the press releases.

Table 3. The top ten stakeholders in CSR reports, sustainability webpages and press releases

	CSR reports	Sustainability webpages	Press releases
Authorities	-	-	37
Board of directors	18	-	74
Companies of own sector	75	35	178
Cooperative companies	104	63	362
Customers	154	123	314
Directors	28	24	-
Employees	193	105	172
Environmental organisations	-	17	-
EU	-	19	-
Finn	-	-	46
Internal working groups	29	-	36
Non-governmental organisations	109	60	120
Passengers	-	-	94
Society	31	32	-
Superiors	20	-	-
Suppliers	-	16	-

- = not in the top ten

The top four is bolded.

The top ten stakeholders in CSR by disclosure type and parts of CSR are presented in Table 4. In this detailed analysis, the differences in the mentioned stakeholders were wider. Companies from own sector, cooperative companies, customers and non-governmental organisations were typically the top four stakeholders. In the social responsibility of the CSR reports, the sustainability webpages and the press releases, the only difference to this were the employees instead of companies from own sector. In economic responsibility of the sustainability webpages, the difference was the society instead of the companies from own sector. In the social responsibility of the press releases the difference was the employees instead of the companies from the own sector. Companies from own sector, cooperative companies, customers and non-governmental organisations were in top ten list of each areas. In contrast, fisherman, general meeting and investors were mentioned only in one area.

Table 4. The top ten stakeholders in the responsibility disclosure by disclosure type

	CSR reports			Sustainability webpages			Press releases		
	Ec.	En.	So.	Ec.	En.	So.	Ec.	En.	So.
Authority	-	-	-	-	9	-	-	9	17
Board of directors	10		17	5	-	7	47	6	25
Companies from own sector	34	33	26	10	19	14	75	25	93
Consumers	-	4	-	-	-	-	-	7	-
Cooperative companies	56	31	41	22	31	28	204	97	129
Customers	78	34	75	31	53	55	174	12	145
Employees	29	26	163	12	16	86	72	-	123
Environmental organisations	-	13	-	-	17	-	-	8	-
EU	-	4	-	12	18	-	-	8	-
Finn	-	-	-	-	-	-	-	-	25
Fisherman	-	-	-	-	-	-	-	5	-
General meeting	-	-	-	-	-	-	21	-	-
Internal working group	-	-	25	6	-	13	21	-	-
Investors	-	-	-	-	-	-	30	-	-
Managers	11	-	16	-	8	19	-	-	19
Non-governmental organisations	34	40	81	23	29	44	38	32	72
Passengers	8	8	-	-	-	-	35	-	61
Society	21	11	21	17	14	26	-	-	-
Superiors	-	-	19	-	-	12	-	-	-
Suppliers	6	-	-	11	-	-	-	-	-

Ec.=Economic responsibility

En. = Environmental responsibility

So. = Social responsibility

- = not in the top ten

The top four is bolded.

4. Discussion and Conclusions

The definitions of CSR and stakeholder differ in the literature. In this paper, the stakeholders are defined as a person or a group of persons or an organisation or a group of organisations that are mentioned in the corporate responsibility disclosure. CSR, then again, is described here as company's responsibility of its economic, social and environmental actions towards the stakeholders.

The aim of the paper is to describe the corporate responsibility disclosure of the case companies from the point of view of the stakeholders. Corporate responsibility disclosure (CSR reports,

sustainability webpages and press releases) of the three Finnish case companies was content analysed. Several different stakeholders are mentioned in the disclosure however most of them only a few times. The most often mentioned stakeholders were customers, cooperative companies and employees. Some differences arise when comparing the top ten stakeholders mentioned in different areas of CSR and disclosure type.

This analysis has a few limitations. First, only a part of the CSR disclosure was analysed. Also the target of analysis covered only one year of reporting. In other words, these results can be called as a snapshot of the CSR disclosure of the case companies. This limitation will be lowered during the project when other parts of the CSR disclosure will be analysed as well. Also, in the future the analysis will cover years 2007–2009 so the variation in time will be analysed. Second, limitation of the analysis is that it only targeted the disclosure. CSR disclosure has been accused of concentrating only on the positive issues and also of being an image raising stunt. The positive tendency of reporting was not analysed in the paper. However, it became very clear that the disclosure presents company's view on the topic, especially in the case of press releases.

In the previous literature, customers, employees and authorities were mentioned as important stakeholders. In this analysis, customers, cooperative companies and employees were mentioned most often. Authorities were not very often mentioned. There are some reasons behind this difference. First, one could argue that does the pure amount of mentions relate with the importance of the stakeholder. The low amount of mentions of authorities, for example, cannot be said to imply that these companies would not regard the authorities as an important stakeholder rather than the selected disclosures are surely not the main disclosure channel towards the authorities.

This analysis is a good starting point for the on-going project. At the same time, it argues for some further analysis. During the analysis, it became obvious that the corporate responsibility disclosure is only company's view of the CSR work and it might not be shared with the stakeholders. The project gives an interesting and important opportunity to compare the official picture of CSR in the company (i.e. corporate responsibility disclosure) with the picture that the company's internal and external stakeholders have. Also, the content analysis will be widened in three ways. First, analysis will cover the disclosure of the case companies from the period 2007–2009. Also, the stakeholder magazines, the annual reports and CSR policies will be added to the analysis. Second, the subthemes of the CSR will be analysed. Third, the analysis will focus on the most often mentioned stakeholders from the point of view of the subthemes of CSR. Also, this preliminary analysis raises the interesting question of who are the target groups of the CSR disclosure and can the target groups be determined by listing and counting the mentioned stakeholders?

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GLOBAL DISPUTE ON SUSTAINABLE BUSINESS: ANALYSING MNE-STAKEHOLDER RELATIONSHIPS IN LOCAL MEDIA TEXTS

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ABSTRACT – *In this paper, we will adopt a stakeholder perspective to studying MNE and examine a green field investment of a globally operating company to better understand the pluralism related to sustainable business. We will present stakeholder identification analysis and stakeholder salience analysis on an empirical setting where Europe's second largest pulp producer, Metsä-Botnia built a pulp mill in South America, in the city of Fray Bentos in Western Uruguay. MNE-stakeholder relationships are depicted as they are represented in local media texts of an Argentinian newspaper, El Clarin. The findings of this study contribute to theory of MNE strategy by using concepts and tools of stakeholder theory for context specific understanding of sustainable business both in the local vs. global and home vs. host country contexts.*

1. Introduction

The values affecting corporations are increasingly pluralistic, and political and ethical responsibilities are ever more pressed upon corporations (Calvano, 2008; Burchell & Cook, 2008; Hendry, 2005). Multinational enterprises (MNE's) face growing challenges in managing the complexity and intensity of interactions across local and global contexts (Meyer, Mudambi, & Narula, 2011). Recent research on MNE's question the established argument that superior performance can be obtained by implementing centralized global strategies, and claims, that a deep understanding of local context is a necessary requirement for success (Ghemawat, 2007). To sustain competitive advantage in complex business environment, firms are required to exercise competitive imagination and to reconcile the perspectives of diverse, dispersed and even adversarial actors (Hart & Sharma, 2004).

To better understand the pluralism related to sustainable business, we adopt a stakeholder view and examine a green field investment of a globally operating company. The study examines MNE-stakeholder relationships in an empirical setting where Europe's second largest pulp producer, Metsä-Botnia (hereafter Botnia) built a pulp mill in South America, in the city of Fray Bentos in Western Uruguay. MNE-stakeholder relationships are depicted as they are represented in local media texts of an Argentinian newspaper, *El Clarin*, and the analysis focuses on the direct firm-stakeholder ties, but also,

the indirect and inter-stakeholder ties that form the dynamic and complex business environment, will be discussed.

Stakeholder literature has made a strong claim that sustainable business is achieved in collaboration with a large set of stakeholders. The principal idea of stakeholder theory is that a company's success depends on the management of its main stakeholder relationships (Freeman, 1984; Clarkson, 1995), and that a business logic based on serving only one stakeholder, the owners, narrows the potential for value creation and imparts a false sense of security (Freeman, Harrison & Wicks, 2007). Stakeholder theory concerns defining and exploring important stakeholders, and analysing the nature of stakeholder relationships, firm-stakeholder interaction processes, and the outcomes of these relationships for organisations and their stakeholders (e.g. Freeman & Evan, 1990; Savage et al., 1991; Mitchell, Agle & Wood., 1997; Rowley, 1997; Jones & Wicks, 1999).

Stakeholders are identified based on the stakeholders' stakes, including interests, values, expectations, and claims towards the focal company (Donaldson & Preston, 1995; Näsi, 1995). The traditional classification approach to stakeholder analysis has been argued to result in static categorisations of stakeholders (Frooman, 1999; Mitchell et al., 1997), and Mitchell et al. (1997) have presented a model for assessing stakeholder salience in order to shed light on stakeholder dynamics. According to the salience model, managers' perception of stakeholder salience is based on stakeholders' power, legitimacy and urgency. Power manifests in one actors' ability to get someone else to do something he/she would not otherwise have done. Furthermore, power in a relationship is based on actors' resources to exercise power. A stakeholder may, however, influence and align itself with other stakeholders who have power in order to indirectly impose their will on managers (see e.g. Zietsma & Winn, 2008). Legitimacy is a perception or assumption that the actions are desirable, proper, or appropriate, and it can be analysed on individual, organisational or societal levels. Urgency adds the element of dynamism to the model, as it is based on the time-sensitivity and the criticality of stakeholder claims, and is thus defined as the degree to which stakeholder claims call for immediate action. (Mitchell et al., 1997.) These three elements have been frequently used in various stakeholder studies to understand the firm-stakeholder relationships and their dynamics (Aaltonen, Kujala & Oijala, 2008; Co & Barro, 2009; Magness, 2008; Neill & Stovall, 2005; Parent & Deephouse, 2007). We use the stakeholder salience approach to analyse MNE-stakeholder relationships.

It has been argued that a company does not respond to individual stakeholder demands, but rather, to the simultaneous demands of multiple stakeholders (Rowley, 1997). In MNE literature, stakeholder demands have only partially been recognised in the integration-responsiveness (IR) framework where local responsiveness pressures present themselves in the form of differences in customer needs, differences in distribution channels, availability of substitutes, the need to adapt, market structure, and host government demands (Prahalad & Doz, 1987). To make the MNE strategies more sustainable and to advocate the adoption of locally responsive strategy, the non-market issues of the list have been emphasised and supplemented with being sensitive to employees' needs (Kujala & Sajasalo, 2009).

The case analysed in this study provides a setting for examining sustainable business from a stakeholder perspective. The pulp mill investment by a Finnish forest industry company Botnia was to be located on the banks of the Uruguay River, which forms the border between Uruguay and Argentina. The board of Botnia made the official decision to build the pulp mill in Fray Bentos on March 7, 2005. The investment was remarkable, firstly, because it was the biggest foreign industrial investment a private

Finnish company had ever made, and, secondly, because the pulp mill project was the biggest industrial investment in the history of Uruguay. According to the World Bank, the mill's completion would increase Uruguay's GDP by 1.6% and create 8,000 jobs for the nation. The government of Uruguay supported the project by granting the pulp mill a free trade area.

The company put a lot of effort in planning in the spirit sustainability. Prior to the decision to invest, during 2003–2004, Botnia carried out studies on pulp production in Uruguay and paid close attention to the environmental and social impact of the mill. The company arranged conferences and meetings to bring together media, local communities and nongovernmental organizations (NGOs). It held local information dissemination sessions in both Uruguay and Argentina, and invited Uruguayan reporters and politicians to visit Finland. Despite of good planning, disagreement about the location of plant arose. There were concerns about the mill polluting the Uruguay River and about the negative influence on revenues from tourism. At first, there was some disagreement between Uruguay and Argentina, but the situation soon erupted into an open political conflict between the two nations. Argentina decided to take the case to the Hague International Court of Justice (ICJ). The conflict burgeoned into a public issue, which attracted various sets of stakeholders, such as civic and environmental organisations, local people, workers, financiers, and the governments of Uruguay, Argentina and Finland.

The investment process has gained a lot of research interest and previous research has covered corporate responsibility activities and stakeholder relations (Kujala, Toikka & Heikkinen, 2009), stakeholder salience and strategies (Aaltonen et al., 2008), legitimacy in corporate social responsibility (Joutsenvirta & Vaara, 2009), the role of media in cultural conflict resolution (Pakkasvirta, 2008), relationships between multinational firms, host governments and NGOs (Skippari & Pajunen, 2010), and corporate responsiveness to social pressure (Lotila, 2010). By looking at the case through the analysis of local media texts, we contribute to the request for further research on discursive strategies employed by the various parties in conflict situations (Walton, 2007).

The remaining of the paper is organised as follows. First, the case under scrutiny is described briefly. This is followed by illustration of the data collection and methods. After that the case analysis is presented and the findings of the research explained and discussed. The paper concludes with a summary of the major findings and implications of the study.

2. Case Overview

The empirical study is conducted on a case where a Finnish forest industry company Botnia invested in a pulp mill in South America, in Western Uruguay. Soon after the investment decision by Botnia, in March 2005, Argentina claimed that the Uruguayan government had not asked its permission to build the plant on the border river, as the use of the Uruguay River is protected by a 1975 bilateral agreement. In addition, members of environmentalist groups and Argentineans living in Gualeguaychu, a city across the river from the plant, protested against it, saying that it would, among other things, pollute the river, foul the area, and ruin the fishing and tourist industries of the area. The Argentine activist group, the Argentinian Citizens Environmental Assembly of Gualeguaychú (hereafter referred to as CEAG), organized massive anti-pulp mill protests and road blocks on the border bridge during spring and summer 2005. Botnia reported, throughout the construction works, that the environmental impact of the mill was being minimized by taking advantage of the best available technology.

In June 2005, the presidents of Uruguay and Argentina set up a joint committee to study the environmental impacts of the mill. In July, the main financier of the mill, the World Bank Group's International Finance Corporation (IFC), started its cumulative impact study. However, in August 2005, Argentina requested the project to be halted pending the completion of the environmental report, and threatened to summon Uruguay to the Hague International Court of Justice (ICJ) to resolve the dispute. The threat was realized in January 2006 when Argentina brought a case against Uruguay to the Hague ICJ, claiming that the construction of the mill violated the bilateral agreement on the use of the Uruguay River. In July 2006, the Court voted 14 to one against Argentina's request, and ruled that Botnia could continue building the pulp mill.

In November 2005, the IFC published the results of its cumulative impact study announcing that the mill would not harm the environment. The Argentinean government declared that the report was preliminary and inadequate. In March 2006, the presidents of Uruguay and Argentina urged Botnia to suspend the construction works for 90 days until an independent environmental impact study had taken place. After the appeal for suspension, the representatives of Botnia stated that the construction would go ahead in spite of the appeal. In April 2006, Botnia halted the works for ten days instead of the 90 days requested by the two presidents and, as a result, relations between the two governments were broken off.

In spring 2006, the president of Argentina and the CEAG pressured the Finnish government to become involved in the conflict, but the government declined to intervene in the affairs of Botnia. Uruguay brought a case against Argentina to the Mercosur tribunals demanding the road blocks to be lifted as they harm the economy of Uruguay. In August 2006, representatives of Argentinean environmental groups visited Finland and delivered a petition of 40,000 signatures from the residents of Gualaguaychú opposing the mill. In October 2006, the IFC and Multilateral Investment Guarantee Agency (MIGA) released the final cumulative impact study for the pulp mill project. According to this study, the mill met all environmental standards and generated significant economic benefits for the Uruguayan economy. In November 2006, the World Bank approved a USD 170 Million Loan to Botnia for undertaking the construction work. Moreover, MIGA agreed to provide USD 350 Million as political risk insurance for the project.

In spring 2007, Argentina and Uruguay tried to resolve the conflict in negotiations mediated by the King of Spain and his representatives. In the negotiations, parties expected the Finnish government and Botnia to participate in agreement building. At the same time, the opponents demanded that the nearly finished pulp mill should be relocated, and in April 2007, there was a vast demonstration of over 100,000 participants. The negotiations between Argentina and Uruguay continued to be unproductive. The construction works were completed in September 2007. In November 2007, the mill was finally started up on permission from Uruguay.

In early 2008, the mill was in full operation and deliveries to customers in Europe and China commenced. The activists continued their protests, insisting that they would not lift the road blocks unless the mill was relocated. In July 2008, the IFC publicly released the first environmental monitoring report of the pulp mill. According to the report, the mill was performing according to the air and water quality standards required by the IFC.

In May 2009, Botnia announced that the mill had reached its planned production, and had produced up to date more than 1,300,000 tons of pulp. In July 2009, a letter of intent regarding Botnia's new

ownership structure was released. It stated that Botnia's Uruguay-based functions had been transferred to UPM-Kymmene Corp., another Finnish forest industry company.

3. Data Collection and Analysis

Stakeholder analysis was performed using media texts. The material was gathered from the largest and most respected newspaper in Argentina, *El Clarin*. The investigated time period starts in March 2005 and ends in May 2009, and thus comprehensively covers the main events related to the pulp mill project from the beginning of the construction works to transferring the operations of the mill to UPM-Kymmene Oy. The newspaper articles were selected by using the search words "Botnia" and "Uruguay" in the electronic archive of the paper. Altogether, 445 newspaper articles were included in our data (Table 1).

Table 1. Number of articles published in El Clarin March 2005 – May 2009

Year	Articles published in El Clarin (n)
2005	35
2006	151
2007	167
2008	77
2009	15
Total	445

The study draws on social constructionist media studies, and treats the press releases and media texts as accounts constructing the social realities of firm-stakeholder relationships instead of reports reflecting the existing reality of those relationships (cf., Gamson et al., 1992). From this perspective, texts form a scene of continuous struggle for the 'right' concepts, meanings and definitions, and are a part of the political and economic power machinery, but simultaneously also a part of their users' meaning production (Fairclough, 1992; Gamson & Lasch, 1983). Thus, while media is considered as one stakeholder, the focus of this research is not so much on describing the role of media in reality construction, but rather, on the ways by which media texts join in constituting the meaning making environment for strategic decision making.

The analysis was carried out in three phases. In the first phase, the research data consisting of media texts in Spanish were gathered by a Spanish-speaking research assistant. The assistant collected the newspaper articles and condensed the contents of each article into a few sentences in English. This resulted to a table in English presenting the events, the related stakeholders and their actions as well as preliminary salience assessment. In the second phase, the table was checked in collaborative process with the research assistant and three researchers in order to discuss and correct any entries that were unclear or open to various interpretations mostly due to translation issues.

In the third phase, three researchers performed a collaborative analysis on the data presented in English focusing on the identification of the stakeholders and on assessing their salience by following the principles of qualitative content analysis (Graneheim & Lundman, 2004; Elo & Kyngäs, 2007). To

examine the stakeholder relationships, stakeholder salience analysis was based on the analysis of power, legitimacy, and urgency (Mitchell et al., 1997). Power was analysed as an attribute of the relationship by examining whether a stakeholder had power relative to others, and by whether the stakeholder was thus able to influence others and the events of the episode. Legitimacy and urgency were analysed as attributes of stakeholders' interests or claims.

4. Findings

First, key stakeholders were identified. As a result of the analysis, 17 stakeholders involved in the case were identified in the newspaper articles. These stakeholders, their actions and roles in the case and the time period of their involvement are presented in table 2.

Table 2. Stakeholders, actions and roles in the case

Stakeholder	Actions and roles in the conflict	Time period
Argentinean government	Opposed the pulp mill project and demanded a suspension of the construction works in order to prevent environmental damage.	2005-2009
Botnia's management	Objective to construct the pulp mill in time and to provide accurate information about the mill to all stakeholders.	2005-2009
Brazilian government	Fearred that the dispute between Argentina and Uruguay will damage the relations of these countries and requested Botnia to delay its construction works.	2006
CEAG	Opposed the pulp mill project and demanded a suspension of the construction works in order to prevent environmental damage and negative social impacts. Later on demanded the mill to be relocated. Pressured the Argentinean government and the local government to take action against Botnia. Organized demonstrations and road blocks.	2005-2009
Church representatives	Argentinean government requested the church representatives of Brazil, Paraguay, Argentina and Uruguay to contribute to solving the dispute.	2006
Citizens of Fray Bentos (in Uruguay)	Supported the pulp mill project to ensure employment and economic benefits for the area.	2005-2007
European Union	Supported the pulp mill project.	2006
Finnish embassy in Argentina	Opposing stakeholders organised demonstrations at the embassy. Embassy representatives discussed with the Argentinean government about the conflict.	2005-2007
Finnish government	Opposing stakeholders demanded that the Finnish government should take part in solving the conflict. The government stated that Botnia is a private company and that the government is not part of the dispute.	2006-2007

Green Cross International	The Argentinean government requested the president of Green Cross International to assist in negotiations to solve the dispute.	2006
Hague ICJ	Argentina brought a case against Uruguay to the Hague ICJ, claiming that the construction of the mill violated the bilateral agreement on the use of the Uruguay River. Later Uruguay demanded to road blocks to be lifted.	2006-2009
IFC	Main financier of the pulp mill project. Conducted environmental assessments of the pulp mill project.	2005-2007
King of Spain and his representative	Led negotiations between Argentina and Uruguay.	2006-2007
Local government of Entre Rios (in Argentina)	Opposed the pulp mill project and demanded a suspension of the construction works in order to prevent environmental damage and negative social impacts.	2005-2009
Mercosur tribunals	Uruguay brought a case against Argentina to the Mercosur tribunals demanding the road blocks to be lifted as they harmed the economy of Uruguay.	2006
NGOs	Opposed the pulp mill project due to environmental concerns.	2005-2006
Opposing Argentineans	Opposed the pulp mill project due to environmental concerns.	2005-2007
Uruguayan government	Supported the pulp mill project because of the economic benefits it would bring to the area.	2005-2009

The pulp mill project was strongly opposed in Argentina. Argentinean government, the local government of the Entre Rios region and the environmental activist group CEAG opposed the mill for environmental reasons. These stakeholders had a common interest in demanding the suspension of the construction works, and they were closely linked with each other. Especially CEAG was active in relationship building as the group pressured the local government and the Argentinean government to take action against Botnia, to take the case against Uruguay to the Hague ICJ and to protest against the assessments released by the IFC. CEAG itself did not have any direct relations to Botnia. Later on during the case, the Argentinean government denied that they had approved of the road blocks and asked CEAG to lift them as it would harm the proceedings of Hague ICJ. CEAG states that no matter what the final verdict of the Hague ICJ, they won't stop fighting as they believe the environmental damage to be gradual. The Argentinean government states that CEAG should be ready to accept the verdict, as they requested Argentina to take the case to Hague ICJ.

In contrast to the tight relations of the opposing stakeholders, the stakeholders that were in favour of the project did not have strong relations among each other, and they did not join forces to show their support. The Uruguayan government and the citizens of Fray Bentos were local stakeholders supportive of the project because of the prospect of it bringing employment and economic benefits to the area. The Uruguayan government was the counterpart of the Argentinean government through out the case and acted as the spokesman for Botnia as well. Botnia's management stated that the conflict is a dispute between the two nations, and that for this reason they do not want to interfere in it. Also, the European

Union expressed its' support to the project stating that Botnia is an innocent victim of the dispute between Uruguay and Argentina.

In addition to opposing and supporting stakeholders, groups that did not have a clear stance in the case were involved, mainly due to the opposing stakeholders' requests for them to interfere with or solve the conflict. These neutral stakeholders can be categorised into conciliators (the Brazilian government, church representatives, king of Spain, the Finnish government and the embassy, and the Green Cross International), courts of justice (the Hague ICJ and the Mercosur tribunals) and financiers (the World Bank's IFC). These stakeholders did not have relationships with each other.

Second, the salience analysis was performed. The salience analysis was used to examine the stakeholder relations in the case, and the analysis was based on the attributes of power, legitimacy and urgency. High salience stakeholders possess all three attributes and are termed definitive stakeholders. Moderately salient stakeholders, i.e. expectant stakeholders, possess two of the attributes and low salience stakeholders, who possess only one of the attributes, are called latent stakeholders. (Mitchell et al., 1997). The results of the salience analysis are presented in table 3.

Table 3. Stakeholder salience and involvement in the case.

	Definitive stakeholders	Expectant stakeholders	Latent stakeholders
Supporting stakeholders	Botnia' management Uruguayan government	Citizens of Fray Bentos	European Union
Opposing stakeholders	Argentinean government CEAG Local government	NGOs Opposing Argentines	
Neutral stakeholders	Finnish government Hague ICJ IFC King of Spain Mercosur tribunals World Bank	Brazilian government Church Finnish embassy	

In table 3 the stakeholders are categorized into definitive, expectant and latent stakeholders according to the attributes that they possess. In addition, the stakeholders are categorized into supporting, opposing and neutral stakeholder to illustrate their different roles in the case. The stakeholders of the case can be almost entirely categorized as definite stakeholders possessing power, legitimacy and urgency or as expectant stakeholders possessing legitimacy and urgency. The only latent stakeholder, the European Union (EU) possessed only one attribute, legitimacy.

The definitive, supportive stakeholders, Botnia's management and the government of Uruguay had an interest to ensure the continuation of the construction works of the mill. The interest of the management was legitimate and urgent, as they had a deadline for starting up the operations. The government of Uruguay had an interest to have the pulp mill ready, but it did not want to do so at the expense of the economy and international relations. The government had power to influence Botnia and

the government of Argentina as well through the negotiations. The interests of the government were legitimate and urgent based on time-sensitivity of the claims. The opposing definite stakeholders had a common objective and through cooperation they increased the power of their common demand. The opposing stakeholders were able to delay the construction works and by drawing international attention to the conflict. The claims were mostly legitimized by invoking environmental and social concerns, and urgent given the dynamic context of the case. The definitive, neutral stakeholders had legitimate power to influence the opposing and supportive stakeholders of the case. The interests of these stakeholders were legitimate, as mostly other stakeholders had requested them to interfere in the case in the first place. Urgency of their interest was based on the dynamic context of the case.

The expectant stakeholders were groups that expected something of the other parties, but did not have the power to directly influence them. The citizens of Fray Bentos had a legitimate and urgent expectation of the pulp mill to bring socioeconomic benefits to the area, even though they were not able to influence the opposing stakeholders or other parties to restrain the dispute that threatened to endanger the expected benefits. The opposing NGOs and Argentineans claimed that the pulp mill will harm the environment, but they were not able to influence the construction works of the pulp mill or other parties related to the case. Similarly, the neutral stakeholders had a legitimate and urgent interest to solve the dispute, but they did not have power to force the parties to negotiate.

The only latent stakeholder was the EU. The EU supported the pulp mill project and had a legitimate interest as it expected Argentina and Uruguay to find a solution to the dispute. This interest, however, was not presented as urgent. As a result of the analysis we can note that both the definitive and expectant stakeholder categories consist of supportive, opposing and neutral stakeholders.

5. Discussion

Global strategies of large corporations supportive of shareholder value thinking so deeply rooted in our contemporary business culture are creating counter reactions presented by actors who are closely related to the local units of large corporations. Stakeholder identification shows the differences in stakeholder claims and allows for grouping stakeholders according to their stance toward the pulp mill investment. Those opposing the investment argued for environmental sustainability while those in favour of the investment argued for the local social and economic sustainability. Both supporting and opposing stakeholders comprised mostly local stakeholders while global stakeholders appeared as neutral stakeholders.

Stakeholder salience analysis indicates that the stakeholders of high salience were the opposing stakeholders. They had power, urgency and legitimacy in relation to the case, and they were the ones that contributed to the escalation of the conflict. In addition, the definitive, opposing stakeholders influenced the definitive, neutral parties and also the expectant, neutral parties during the case. The definitive, supportive stakeholders acted as a counterpart to the opposing ones.

In a study of conflict situation, complementing the salience analysis with an analysis of the roles of the different parties allows for a better understanding of the dynamics of the stakeholder relationships. The host country stakeholders had power both in terms of salience and determined stance towards the investment. The home country stakeholders had power in terms of salience but appeared as neutral towards the dispute.

The analysis of this case illustrates how a locally based dispute gains a significant attention both in home and host countries of an MNE and has an impact on global relations. Compared to the stakeholder analysis performed on the respective data collected in the Finnish media (Kujala et.a. 2009), it can be stated that the *El Clarin* data focuses on local, Argentinean and Uruguayan stakeholders and relationships between them. The political relationships both within and between the two nations are covered, in particular. The focal firm, Botnia, does not seem to play a major role in the newspaper articles. Not much is discussed about Botnia's relationships to its stakeholders. In addition, the Finnish media covered more the stakeholder relations between the company and its owners, customers, employees from both Finland and Uruguay, and trade unions.

6. Conclusion

In this paper, we adopted a stakeholder perspective to studying MNE and examined a green field investment of a globally operating company to better understand the pluralism related to sustainable business. We presented stakeholder identification analysis and stakeholder salience analysis in an empirical setting where Europe's second largest pulp producer, Metsä-Botnia built a pulp mill in South America, in the city of Fray Bentos in Western Uruguay.

The findings of this study contribute to theory of MNE strategy by using concepts and tools of stakeholder theory for context specific understanding of business both in the local vs. global and home vs. host country contexts. The salience analysis combined with analysis on the roles of stakeholders allows for taking into account the different stakeholder impacts on competitive advantage of a firm, and thus, leads to more profound theorizing on sustainable business compared to theories that take the shareholder perspective as the taken-for-granted assumption. This study contributes to research on the informal norms, values and social responsibilities that both home and host countries of MNEs impose on these companies (cf. Peng & Pleggenkuhle-Miles, 2009). The study provides support for the claim that stakeholders' significance depends on the situation and context (Savage et al., 1991; Roloff 2008).

A limitation to this study is that stakeholder analysis is performed based on data collected in newspapers. Media texts are not naturally occurring data as they are also socially and politically constructed. Newspaper articles reproduce reality and often join in nation-building by positioning the issues in national terms (Li, 2009). Thus, the data may have a national bias, and thus, direct attention to local stakeholders. To limit this bias, we have also studied media coverage by a Finnish national newspaper, Helsingin Sanomat. The results show that the stakeholders identified in both newspapers' articles are the same and that there are no substantial differences in depicting the roles of stakeholders.

As a managerial contribution, this article provides a usable method of analysis to assess the interests of different stakeholders. A better understanding of the interests of different stakeholders allows for a building a solid ground for sustainable business that seeks not only to meet the shareholder needs but also the needs of other stakeholders.

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PURPOSE OF SUSTAINABILITY CONTRACTUAL CLAUSES

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1. Introduction

Corporate social responsibility (CSR) is usually understood as a set of business measures consistent with law and ethical standards under which companies accept the responsibility for the effects their activities have on the environment and society. This article will concentrate on the socially responsible performance of businesses in the form of inclusion sustainability contractual clauses (SCCs) into contractual undertakings. For the purpose of this article, SCCs are understood as contractual provisions covering social and environmental obligations that are not directly connected to the specific performance of the parties under the individual contract and that are traditionally subject of government regulation. An example of a SCC may be a provision of a supply agreement in apparel industry prohibiting use of child labor during the manufacturing process, a provision of a license agreement for pharmaceuticals requesting a strict obedience with anti-bribery rules, or a provision of a construction agreement determining how water supplies should be used by the builder.

From the definition above and the provided examples, the specificities of SCCs urging to discuss them separately from other contractual provisions seem apparent: they do not directly relate to the subject matter of a contract, and they implement general public concerns instead of economic concerns of the contractual parties. Therefore, the reason for inclusion of SCCs into contracts is not a value maximizing in relation to the specific deal, but rather risk management connected to unethical behavior and a value maximizing in a long-term perspective. The specific qualities of SCCs do not, nevertheless, mean that we cannot find parallels to other types of contractual clauses such as recitals, interpretation clauses, product specification clauses or warranties clauses.

According to the empirical study conducted by Vandenberg (2007, 916-917) more than 50% of the investigated companies imposed environmental requirements on their suppliers. A later research (IACCM 2010) shows that the number is growing rapidly; by 2010 the number exceeded 80%. These data prove that incorporation of sustainability related requirements into business contract is a widespread tactic among business. However, companies are often not sure about the actual legal purpose and consequences of it.

Despite the frequency of the SCCs' occurrence, they have drawn surprisingly little attention of legal scholars. The contract law has come into focus of research dealing with CSR only in last few years

(Vandenbergh 2007; McBarnet and Kurkchiyan 2007; Cafaggi 2010). Building on the previous academic works and analysis of the existing legal instruments, the present paper intends to contribute to the discussion on the role of contract law in the CSR regulation and to build a conceptual framework for future legal studies in the area of SCCs. By analyzing the legal purpose of SCCs, the role of companies in the global regulation of CSR may be assessed and the related opportunities and limitations explored. Knowing the legal purpose of SCCs helps us to understand also their legal effects. This knowledge may conduce to better regulation for the global sustainability.

After providing background to the topic in section 2., section 3. provides an overview of the relevant literature. Section 4. then presents a legal analysis of the applicable regulations. In section 5. the conceptual framework of SCCs is developed proposing four main aims of SCCs. Finally, section 6. concludes the paper with discussion on the usability and limitations of the study and outlines directions for future research.

2. Background of SCCs

2.1. Corporate Social Responsibility

It is the primary purpose of business to strive for profit within the applicable legal framework. Going beyond legal requirements usually brings additional costs and as such it is not natural for a business and must be justified to the shareholders. So why do companies wish to govern matters not directly related to their business performance?

Although extensively discussed by both academics and practitioners, there is still not a globally accepted definition of CSR. The ambiguity of the concept hinders its effective regulation and complicates communication among entities from different geographical areas and different industries. The existing definitions differ depending on the understanding of the CSR's scope.

Even though the CSR activities are often referred to as voluntary and covering only matters beyond law, there is a range of arguments proving the opposite view (Zerk 2006, 32 et seq.). Firstly, compliance with legal obligations is often listed among the top requirements in corporate codes of conducts. Secondly, various official statements and policies (e.g. the EU Green Paper – Promoting a European framework for Corporate Social Responsibility) consider legal obligations as an integral part of CSR together with voluntary actions. And thirdly, a merely voluntary approach to CSR was repeatedly stated to be misleading (McBarnet 2007, 4; Ward 2003, 3; Sobczak 2006, 168) as overlooking a range of drivers factually forcing companies to adopt environmental and social concerns into their business operations; these include indirect legal regulation and social and economic incentives.

The anticipated legal, social, and economic pressure on socially responsible behavior of companies is further intensified by a growing expectation that enterprises shall take responsibility not only for themselves but also for their supply chain (OECD Watch 2004). In order to protect their good name and long-term profits, they are asked to ensure that their suppliers and other business partners respect the same ethical standards (Sorsa 2008, 141). Neither regulators nor public, however, give to companies guidelines for achieving this goal and they are thus left alone to figure out the optimal and suitable legal ways to comply with this expectation.

2.2. International regulatory environment of CSR

Hand in hand with economic globalization, the transnational scope of business activities has grown rapidly during the last few decades. This development has created problems to track cross-border impacts of business activities and subject them to national regulations. National law thus does not provide states with efficient legal tools to enforce CSR obligations internationally (Mayer and Gereffi 2010, 1). Moreover, unlike state, companies are traditionally not subjects of international law either.

Given the insufficiency of national and international law in regulation of transnational business, governance gaps have been created. As a result, internationally operating businesses may take advantage of such “legal vacuum” (de Jonge 2011, 67-68), escaping the liability for the effects of their cross-border activities. Therefore, there is a definite need to discover and establish new regulatory regimes to remedy this governance deficit.

Since states are not able to adopt and enforce legislation securing compliance of business behavior with the CSR principles, other subjects incurred this task. These are primarily non-governmental organizations, international organizations and also companies, gaining political authority and governance capacity simultaneously with their growing economic power (Backer 2007). All these subjects adopt a different type of private regulation having autonomous regulatory power or implementing delegated power from national or international law (Cafaggi 2011, 1). Private regulation may be generally defined as regulation developed by non-state actors whose “*legitimacy, governance, and implementation is not rooted in public authority*” (Vogel 2010, 69) and may have the form of standards or guidelines developed among private parties (business private regulation) or in collaboration with governments (co-regulation) or by a single entity, usually adopted as codes of conduct (self-regulation) (Albareda 2008, 434).

Transnational private regulation deals with various CSR related topics and adopts various types of monitoring and enforcement mechanisms. However, it suffers from several deficiencies (Cafaggi 2010, 2). First of all, its legitimacy is often questioned by legal theory and political science (Lambooy 2010, 256 et seq.). On a national level, the legitimacy of law is derived from the state governance. But there is no substitute of such an authority on the transnational level since a decision-making center is absent there given the number of actors involved (Curtin and Senden 2011). Thus, subject of these rules do not feel to be obliged to comply but perceive them only as motivational and voluntary regimes based on underlying moral imperatives. Given the foregoing, private regulation has mostly the form of soft law (Shaffer and Pollack 2010) having no legally binding power. The uncertain legitimacy of such regulation leads to lower effectiveness.

Effectiveness is another drawback of private regulation. The effectiveness of private regulation within CSR is undermined not only by the unclear legitimacy, but also by a lack of verifiable reporting and monitoring systems (de Jonge 2011, 72). Even though some states have recently adopted mandatory CSR reporting schemes, companies are still not directed what CSR activities they should perform, but rather are expected to inform the authorities about the reason and substance of the CSR policies they undertake. These rules thus works as meta-regulation and as such are of procedural character. They are not connected to any substantive rules and cannot fulfill the role of monitoring systems of private regulations.

Finally, enforceability is another focal problem of private regulations. Generally laws are enforced by states that derive their authority from the democratic representation of society. As stated above, in transnational private regulation no central authority is present. Moreover non-binding transnational private regulation is not subject to judicial review. Courts or deciding tribunals may, however, refer to it or enforce it indirectly. The enforcement of private regulation is then realized by using other legal instruments provided for example by advertising law, consumer law, labor law, or contract law.

Despite the described deficiencies, private regulation plays an important role in CSR. It sets standards reflecting society's perception of consequences of corporate conduct on international level and thus guides businesses how to address social and environmental matters. Moreover it provides reporting and monitoring tools that are used as indicators of CSR.

2.3. Contracts - how do they fit in the picture?

Companies, expected not only to behave in an ethical way themselves but also to foster such behavior throughout their supply chain while operating in fragmented and unclear transnational regulatory environment, must search for legal tools to live up to the expectation. Contracts are an obvious path to go, allowing direct influence over another company's performance.

Contracts help to cope with the deficiencies of private regulation giving to a soft law a hard law edge (Cafaggi 2011, 41-42). By incorporation of soft-regulation into contracts it becomes binding and enforceable upon parties. Further, in complex international supply chains, contracts help to overcome the difficulties with control of all of their members' performance, given that all their tiers are interconnected by different contractual relations. With the shift of the global economy from an individual company driven business to business driven by networks and value chains, contracts have gained new function (Cafaggi 2010). By including sustainability concerns not directly related to the subject matter of a contract the notion of contract is changing. It is losing its traditional role of a legally enforceable exchange of promises, under which one party delivers goods or services and the other party pays an agreed price. Contracts are not any more mere sets of rights and obligations of the parties but also tools to state and secure parties' common business goals and ethical values and to regulate parties' relationship and communication (Macneil 1980; Gudel 1998, 786). In the CSR area, contracts are becoming more self-regulatory tools influencing overall, not only contract related, behavior of the parties. The question is whether contracts channel regulation or whether they are regulation themselves.

The above described contract paradigm shift brings a variety of new problems and legal issues. Contracts concluded under this new perspective and SCCs therein are optimally self-enforcing. This should lead to the enhancing of socially and environmentally responsible behavior on the global level. However, such optimal scenario is many times far from practice. So, we must ask whether SCCs are or have the potential be an effective and efficient tool for enhancing global CSR. And from there a question arises: what should be done in order to fulfill the *ultimate goal* of promoting global sustainable development as well as business growth?

I see the first barrier to realization of the *ultimate goal* of SCCs in the fact that the legal role and power of SCCs has not been established yet. Companies are incorporating SCCs without being aware of the role they want or may play in the regulatory environment and the legal effects they want to achieve. The article suggests that the legal purpose of SCCs is essential for evaluating their legal effectiveness as

well as their contribution to the sustainable development. Therefore a conceptual framework is developed in order to study the legal effectiveness of SCCs in respect to enhancing sustainable development.

The insufficient legal framework appears to be the second barrier to the realization of the *ultimate goal* of SCCs and to their use generally. The existing contract law seems unsuitable to deal with often unspecific sustainability contractual provision. Therefore new regulatory regimes and combination of the existing regulations should be sought to establish an adequate legal framework allowing and securing legally effective use of SCCs in international business relations.

The third barrier to the realization of the *ultimate goal* of SCCs is the vague character of the ethical standards. The contractual parties have great difficulties formulating SCCs precisely enough to be enforceable and broadly enough to comprehend the underlying ethical principle.

The present paper aims to contribute to overcome the first barrier by examining what the legal status and power of SCCs is. The method chosen is conceptualization of SCCs based on a literature review and a legal analysis of selected hard and soft legal instruments currently in force. The findings should then assist and ease overcoming of the second and third barriers.

3. Literature review

3.1. Scope of literature

This part of the article provides a brief overview of legal literature addressing specifically the role of international private contracts within the CSR area. Only selected writings are covered representing the major thoughts on the matter developed within the period from 2006 to 2011. Papers containing analysis of contract law or contracts in CSR only as a marginal issue or mainly from other than legal perspective (such as political science) or geographically limited case study papers are not included. This literature review is taken as a starting point in developing a conceptual framework for research within the SCCs. It helps to conceptualize the SCCs and their role in the business and the regulatory environment.

Literature dealing thoroughly with different purposes and the role of contracts in the regulatory environment of CSR is only scarce (Vandenbergh 2007, 925-926). Since the failure of public governance within the CSR area became evident and new types of private governance emerged, legal scholars have focused primarily on the transnational private regulation resembling the traditional public governance (Vandenbergh 2007, 915), such as standards developed in public-private cooperation, business set of standards, or industry self-regulation. Although the fact that multinational companies may directly influence their suppliers and business partners had been acknowledged, codes of conduct had been the focal point of the legal scholarship in this area, and the governance through private contracts had remained unnoticed for a long time. The interest into governance of CSR issues through private contracts mirrored the economic growth of enterprises (Mayer and Gereffi 2010, 5). Emerging during nineties, it accelerated after 2005 following the extensive publication about sustainability strategies and codes of conduct of leading multinational enterprises, such as Wal-Mart, Inc. (Vandenbergh 2007; Backer 2007).

3.2. Overview

The legal scholarship assigns to SCCs various roles. Lundblad (2005) discusses the objective of codes of conducts to *influence* behavior of suppliers. He suggests that this objective may be achieved by inclusion of a code of conduct into a supply contract. The word *to influence* indicates two different aspects of SCCs: an incentive for suppliers' positive attitude towards CSR and an actual ability of contracts to affect suppliers' behavior.

Vandenbergh (2007) provides deeper analysis of SCCs based on empirical data. He claims that private contracts are an important *means of global environmental governance*. He discusses two of the generally recognized features of "governance" and compares them to the features of private contracting. One of them is the accountability of rule-takers. In the case of a private contract, unlike in a governmental regulation, this accountability is missing. Nevertheless, another type is present – accountability to the companies' stakeholders. This type of accountability is also referred to as the social license to operate. The other discussed feature is the collaborative approach in governance (Albareda 2008; Rasche 2010), meaning that a regulation, whether it is a government regulation or a transnational private regulation, addresses common problems in group decision-making. This feature is generally absent in private contracts concluded merely between two private parties, but according to Vandenbergh may be present when private contracts incorporate collective standards. In my view, the collaborative aspect is embedded into all SCCs, since companies thereby respond to a rather specific pressure of their stakeholders who thus participate in shaping of the SCCs' content.

The governance ability of SCCs is discussed also by Backer (2007) who examines how Wal-Mart uses "*contractual relationships to legislate behavior among its suppliers*". The word *legislate* indicates that contracts are used to create new rules, new law. Backer presents two ways how the legislative effects of private contracts within the CSR issues may develop. Firstly, contractual provisions may evoke development of international customary business law. This implies that the regulatory function would not be embedded directly in the contracts but rather in a new set of rules evolved based on their content. Secondly, private contracts can be seen as a legislation of its own, setting new standards for Wal-Mart's suppliers. The legislative character of Wal-Mart's contracts stems from the company's economic power. Next to the legislative function, Backer also mentions other roles of private contracts in the CSR regulatory environment; the mission within the *legal enforcement* and the power to *deploy business relationships* by harmonizing values and norms of the parties.

The enforcement role of SCCs is further developed by McBarnet and Kurkchian (2007). Based on empirical data obtained from interviews, case studies, and empirical desk research, they analyze the regulatory and enforcement potential of private contracts in enhancing global CSR. The regulatory purpose of SCCs is described as rather low since it appears from the data that the majority of the issues covered by contracts are already implemented by local laws, however, states fail to enforce them. Therefore, contracts are seen in the first place as an *enforcement mechanism* of standards set by international and local laws and corporate codes of conduct. The authors stress the significance of "soft" contracts (relational contracts) and their ability to, if not set new standards or enforce existing, *motivate* companies' suppliers to adopt socially responsible behavior. Even though McBarnet and Kurkchian recognize the importance of private contracts in a sustainable supply chain regulation, they also draw attention to their many limitations.

Schwenzer and Leisinger (2007) approach the use of international contract law within the CSR area from different perspective, concentrating on the technical character of international sales contracts. They introduce an indeed original idea that some of the corporate social and environmental obligations are comprised in the trade usage (according to art. 9 (2) of the United Nations Convention on Contracts for the International Sale of Goods (CISG)) and as such constitute implicit provisions of all international contracts for sale of goods. They further discuss contracts as an *enforcement means* for the corporate ethical values and legal obligations, providing concrete analysis of an applicability of the CISG's provisions on remedies on the SCCs.

Finally, Cafaggi (2010) is engaged with defining the role, potential and effects of private regulation, self-regulation and contracts within global governance. He recognizes two main legal purposes of contracts containing SCCs: complementing state *regulation* and *enforcement* of existing soft-law. Cafaggi emphasizes the limitations of bilateral contracts to effectively regulate performance of international supply chains beyond the first tier. He suggests that better results are achieved by using contractual networks involving all tiers of a specific supply chain. These contractual networks adopt common monitoring and relational enforcement mechanisms and as such resemble regulation to larger extent than a line of bilateral contracts.

3.3. Conclusion on literature

From the overview above it is evident that three possible roles assigned to SCCs are repeatedly mentioned by current legal scholarship. SCCs are considered, first of all, as a motivational tool for CSR performance among supply chains (Lundblad 2005, Backer 2007, McBarnet and Kurkchian 2007). Even though the enforcement of SCCs may be questionable, their capability to motivate business partners is widely recognized.

Secondly, the SCCs are seen as a means used to enforce already existing but not efficiently enforced soft and hard legal obligations (Backer 2007, McBarnet and Kurkchian 2007, Cafaggi 2010). This purpose is often connected to the situation in developing countries where local governments either do not give proper significance to ethical issues in relation to business or they do not enforce them being concerned not to discourage foreign investment.

Finally, a regulatory power is often attributed to SCCs (Vandenbergh 2007, Backer 2007, Cafaggi 2010). The possibility to introduce new rules within international contracts is again highlighted mainly in connection with relationships between western-based companies and companies from developing countries. In this case, contracts may complement or even substitute local regulation which may be insufficient in comparison to standards applicable in developed countries.

4. Analysis of existing regulation

4.1. Scope of regulation

A body of legal regulation demanding companies to ensure sustainable behavior on their foreign suppliers is constantly growing. The regulatory types differ significantly, including international soft-

law, transnational private regulation and national law with extraterritorial effects. Most of these instruments contain provisions relevant to international business contracts. In order to assess and classify the purpose of SCCs it is necessary to analyze these instruments to determine what is required by regulation from companies regarding sustainability issues in their business contracts.

Given the scope of the article, it is not possible to scrutinize exhaustively all effective laws and regulations, thus the analysis focuses on the ones most widely recognized and accepted within international business. Since the research is specialized on international supply agreements, only those regulations with global geographical reach are included. Further, the article is not focused to any specific industry; therefore only cross-sectoral instruments are examined. Finally, two examples of national laws with extraterritorial implications are provided to illustrate how these legal instruments affect the use of SCCs in international supply agreements.

4.2. Analysis

The existing CSR regulation uses different modes when referring to the CSR performance among supply chain members and a leverage of one company over others in this context. The EU Green Paper is probably the vaguest one, not directly tackling the issue of private contracting. It is built on an entirely voluntary approach to CSR and stresses that practices adopted by companies are not to be deemed as a substitute to legislation. It suggests that companies “*should pursue*” CSR through the whole supply chain (Introduction, point 12), but it does not provide any practical guidance.

Important international organizations contributed to the regulation of private contracts within CSR by several initiatives, having also very soft character which may be caused by the great amount of heterogeneous interests of their members. The Organization for Economic Co-operation and Development has adopted a set of voluntary recommendations, Guidelines for Multinational Enterprises (the OECD Guidelines). The OECD Guidelines address relationships among businesses in its section II., General Policies, which states that enterprises “*should encourage, where practicable*” to apply the OECD Guidelines by their business partners. Commentaries to the OECD Guidelines acknowledge existence of “*practical limitations to the ability of enterprises to influence the conduct of their business partners*”. This, although maybe a realistic view, does not explore the full potential and contractual power of multinational enterprises on the global market and poses great boundaries to enhancing CSR through private contracts.

Several CSR related initiatives were introduced by the United Nations. The most known, Global Compact contains 10 voluntary principles representing core ethical values to be adopted by businesses. In the introduction, the Global Compact members are asked to “*embrace, support and enact*” the rules “*within their sphere of influence*”. The concept of “sphere of influence” is a subject of an interpretation and a broad discussion, but it is generally recognized that contractual control falls within its scope. The use of business contracts to enhance CSR within supply chain is thus not requested directly by the text of the Global Compact but may be read between the lines. For example, the principles one and two ask companies to make sure that they are “*not complicit in human rights abuses*”. This requirement actually means that companies must be fully aware of the CSR performance within the whole supply chain; else they may be accused of a beneficial or a silent complicity. The Global Compact thus anticipates that companies have means to control the behavior throughout the whole supply chain. Contractual control

then represents the strongest tool for companies in this respect. Given the above, the overall attitude of the Global Compact to the governance of supply chains thus appears to be predominantly as assigning to contracts an enforcing role. But soft, relational ways of enforcement are envisaged.

The UN Norms on the Responsibilities of Transnational Corporations and Other Business Enterprises with regard to Human Rights (UN Norms) were developed with the intention to become a binding instrument. However, even though derived from customary international law and international treaties, they remained only a soft-law instrument. Nevertheless, the contractual power of companies is fully explored here and expected to be used for enhancing socially responsible behavior throughout supply chains. Article 1 states that companies have within their “*sphere of influence*” (UN Human Rights Council 2008) “*obligation*” not only to “*promote*” but also to “*secure*” respect for and fulfillment of human rights. The obligation is further detailed throughout the text and in article 15 the contractual practices are tackled. According to this provision, companies should “*incorporate the UN Norms into all their contracts*” and do business only with entities following the UN Norms or other similar set of principles. Contracts thus serve as a tool for enforcement of internationally accepted human rights standards and principles. The UN Norms on the other hand exclude business persons from regulatory activity within the CSR area. According to article 17 it is the responsibility of states to establish the legal framework.

Next to international organizations, also business associations are active in regulating CSR. The International Organization for Standardization, associating governments as well as business entities, adopted in 2010 a new Social Responsibility standard, the ISO 26000. It addresses the issue of spreading CSR performance throughout business networks by various modes. From the softer, motivating ones, it uses words as “*promote*” (Clause 4.4.) or “*encourage*” (Clause 6.4.3.2.). But the overall approach of ISO 26000 seems to be more than mere vague motivation for the CSR performance. The instrument acknowledges companies’ capability of political and regulatory involvement within the CSR area, which means that companies are expected to use their leverage to positively influence the regulatory environment of CSR and must refrain from decisions and activities that could have negative direct effects on the same (Clause 6.6.6.). The ISO 26000 thus expects from companies to get actively involved in motivating their business partners towards socially responsible behavior, requests them to enforce existing rules at least in the sense that they should avoid and influence their business partners to avoid any negative impacts, and assign them the right to engage in regulation development.

Business Social Compliance Initiative, a non-profit organization, issued a Code of Conduct, which is open to be joined by companies and other institutions. The Code of Conduct states that by signing it entities commit themselves to take appropriate measures to ensure “*implementation and compliance*” with the rules within their “*sphere of influence*”. Although the BSCI Code of Conduct does not provide a definition of sphere of influence either, the request to use contracting as one of the appropriate measures can be derived from its text and, especially, from the Declaration of Liability Regarding Compliance with the BSCI Code of Conduct (Declaration) that must be signed by entities when becoming a BSCI member. In the Declaration, entities undertake to *ensure* that all of their subcontractors will observe the same standards and to make compliance with social standards and the BSCI Code of Conduct a *condition of all their contracts*. Non-compliance of a subcontractor must be sanctioned by termination of the relationship, if the parties cannot find another suitable solution. The BSCI thus seems to go the furthest with the request of incorporating SCCs into business contracts.

The SA8000, a certification based standardization system developed by the Social Accountability International, contains also a set of auditable voluntary standards derived from international conventions on labor and human rights. Section 9.9 of the standard require companies to make “a reasonable effort to ensure” compliance also of its suppliers and contractors within the “*sphere of control and influence*”. This requirement, merely directing companies to motivate their business partners’ CSR performance, is much softer in comparison to the BSCI.

Although the regulation of SCCs appears mostly on transnational level, states also try to enhance cross-border CSR. An example may be the US law combating corruption, the Foreign Corruption Practice Act (FCPA). It has a form of a meta-regulation with the basic purpose to enhance *enforcement* of the existing anti-corruption practices by companies within their international supply chain. The law motivates companies to incorporate anti-bribery provisions into their contracts by imposing lower fine in case that a corruption practice is discovered if a company has effective measures, for example SCCs, in place. The law has extraterritorial effect, governing activities of US companies abroad or of foreign companies in US; therefore its influence has expanded also to Europe and other parts of the world.

The new Californian law combating human trafficking in supply chains, the Supply Chains Transparency Act, which will enter into force on January 1, 2012, intends to have a similar effect as the FCPA. According to this law every company doing business in California shall report on its measures, including their contracting activities, taken in order to prevent occurrence of human trafficking and slavery in its supply chain.

4.3. Conclusion on regulation

Even though all the mentioned CSR regulations touch upon the usage of SCCs, it seems that the regulators approach them rather reluctantly and often indirectly. The reason may be that contracting is traditionally an autonomous business activity, in which regulators interfere only in the most urgent cases, primarily when a weaker party has to be protected (*e.g.* consumer contracts). Thus, within the CSR area, the existing regulation ascribe to business contracts mostly motivational or enforcing function, placing companies in the position of rule takers who, however, possess practical means to enhance observance of the (often vague) CSR principles. The motivational function can be found in each of the mentioned regulation; most obvious in the OECD Guidelines and the ISO 26000. By the majority of the regulations, contracts are also seen as an appropriate tool for enforcing standards set in soft laws and private regulations with unclear binding power. Soft enforcement based on relational tools appears to be preferred by international organizations. Harder enforcement methods are then anticipated by business initiatives, using termination of a contract as the ultimate sanction.

There is no unified approach within the mentioned instruments towards the regulatory purpose of SCCs. In regulation developed by non-state actors, companies are not restrained from going beyond enacted standards but are not requested to do so; in order words, the regulatory function of contracts is generally accepted but not anticipated. This does not seem to be the case of national legislation and instruments developed among governments, who may not be willing to confer legislative power to companies, giving their own jurisdiction “out of hands”.

5. Conceptual framework

5.1. Business v. legal purpose

Business purposes for SCCs' incorporation into private contracts are similar to the ones often associated with the general business approaches to CSR, classified by a vast number of academics from different fields (e.g. Porter and Kramer 2007; Tulder van, Wijk van and Kolk 2009; UN Global Compact 2004). However, a business purpose of a SCC may not always correspond to its legal purpose. Regardless of the underlying business purpose, by inclusion of a SCC in a contract, it takes on a specific legal role. The legal role varies depending on technicalities, such as a placement of a provision within the text of a contract, on external influences, such as the character of a regulatory environment of a supplier's location, and also on internal factors, such the level of the buyer's commitment to CSR. Where there is a lack of commitment, the company's attitude towards use of SCCs is predominantly defensive with the objective to "do not do things wrong" (Tulder van, Wijk van and Kolk 2009, 401), to avoid risk connected with a non-ethical behavior, and to pass the risk to the supplier without intention to positively influence sustainable performance on the supplier's side or without understanding the CSR opportunities in a strategic way. If a company's overall approach to CSR is an active one, meaning that it realizes that it may not only comply but also "do the right things" or even "do the right things right" (Tulder van, Wijk van and Kolk 2009, 401), the attitude towards using of contracts as a CSR tool seems to shift from defensive to strategic. In this case the business purpose will more probably be harmonized with the legal purpose of SCCs. Both defensive and strategic use of SCCs may result in motivational, enforcing, or regulatory legal effects. But, only when SCCs are used strategically, the legal effects will likely correspond to the legal purpose. Therefore, only the strategic SCCs are hereby further classified.

5.2. Classification

Defensive SCCs without specific legal purpose will often not be used in a systematic way, which may make it difficult to anticipate their legal effects and placement within the text of a contract. The legal scholarship dealing with SCCs does not acknowledge such an approach, maybe due to their very limited and only incidental legal effects. The CSR regulations show that the defensive approach is not recognized by them as a valid incentive either. This is coherent with the actual reason of regulating the area; the point is to avoid such a behavior among businesses.

The majority of the analyzed CSR regulations ask companies to use the potential of their contractual relationship to enhance CSR through motivating their business partners or to enforce their business partners' compliance with existing but non-binding or non-enforced legal rules. The **motivational** purpose of SCCs is most obvious when they are incorporated in interpretation clauses or in recitals of a contract. These clauses do not generally stipulate rights and obligations of the parties but rather set the mode in which a body of a contract should be read and the context it should be interpreted in. The legal effects of recitals and interpretation clauses are not settled by a contract law theory and may differ according to the legal tradition the contract is drafted and interpreted in (Fontaine and De Ly 2006, 59-186).

As the analyzed literature shows, the **enforcement** role of SCCs should be connected with the fact that transnational CSR regulation has predominantly a soft form and there are no international procedures in place enabling effective enforcement thereof. A contract as a binding legal document thus substitutes governmental enforcement power. The enforcement purpose of SCCs is achieved by enforcement processes available under a specific contract. This includes not only penalty clauses but also relational enforcement means, like self-assessment or auditing of suppliers, which seem to be the preferred method securing compliance with ethical standards among supply chains.

The strategic **regulatory** approach will allow to minimize the risks and to use the opportunities of SCCs strategically. Under this approach, a company will employ its contractual power not only to secure its own compliance and motivate and enforce compliance of its suppliers but also to regulate important issues, not dealt with in the existing regulation. Such SCCs will be often found in the main body of a contract specifying the contractual parties' rights and obligations. This extension of contractual power is not anticipated by the existing regulation for already mentioned reasons; however, is recognized by legal scholarship. The question is where the borderline between SCCs and regulation, especially self-regulation, lies. The regulatory purpose of SCCs is probably the most questionable one from the perspective of legal theory and, therefore, needs more attention of research in the future.

6. Conclusion

The article presents a new approach to business contracts as a means of CSR. It suggests a conceptual framework under which effectiveness and potential of SCCs may be further examined. Using findings from literature review and analysis of existing CSR regulations, the framework classifies the SCCs according to their legal purpose into four categories: defensive, motivational, enforcing, and regulatory. It is found that a legal purpose does not always correspond to the underlying business purpose. Only when these two objectives are harmonized, it is possible for a company to explore the full strategic potential of SCCs.

The framework has certain limitations that could be, however, overcome by future research. Firstly, business purposes of SCCs should be examined empirically in order to establish more precise connection between the legal and business objectives. Further, the framework does not provide link between legal purpose and legal effects which may differ substantially. Here again, more research is needed to discover the real potential of SCCs in the CSR regulatory environment. I anticipate that the legal effects will depend primarily on the regulatory and enforcement environment of the specific supplier's location.

Secondly, the use of SCCs is certainly influenced by a power distribution between the contractual parties. This article works with the assumption that a buyer has a greater power but it does not need to be the case every time. In connection to this issue, also a mutual attraction between the contracting parties should be examined to realistically assess the SCCs' impact.

Despite the mentioned limitation, the proposed conceptual framework may help us to understand the role and potential of sustainable contracts. It may serve as a starting point for future research in the area of law as well as economics of sustainability. If a company realizes the legal purpose of SCCs' inclusion into contracts, it may optimize drafting of its contracts and targeting of complementary management activities in order to harmonize the business and legal objective and thus to achieve the intended legal and business effects. The framework may also help regulatory bodies to direct better their focus in the future regulations and enforcement activities.

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DISCLOSURE OF MATERIAL CSR INFORMATION – COMPARISON OF THE MANDATORY CSR DISCLOSURE SYSTEMS FOR LISTED COMPANIES IN THE EU AND THE US

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1. Introduction

The phenomenon of Corporate Social Responsibility (CSR) is attracting increasing international attention. The attention from legislators manifests itself in mandatory disclosure of certain pieces of information related to the companies' CSR in many jurisdictions. In the US, the Securities and Exchange Commission (SEC) mandates the disclosure of certain environmental and climate change related information (SEC, 2010). Similarly, in the EU the disclosure of certain non-financial key performance indicators, including information relating to environmental and employee matters is required (Directive 2003/51/EC of the European Parliament and of the Council of 18 June 2003: Article 1(14)(a) and Article 2(10)(a)). In both jurisdictions the disclosure requirements of CSR information are limited in comparison to the disclosure requirements pertaining to financial information. Firstly, the requirements are much less specific than in the case of financial disclosure. Secondly, the requirement of disclosure is contingent on certain normative conditions, which have been developed for the assessment of the obligation of disclosure of financial information; thus, their use in respect of CSR related information is ambiguous. In the US only that piece of environmental or climate change related information must be disclosed, which is also material (SEC, 2010), while in the EU only those pieces of information which are “necessary for an understanding of the company's development, performance or position” (Directive 2003/51/EC of the European Parliament and of the Council of 18 June 2003: Article 1(14)(a) and Article 2(10)(a)).

Since the aforementioned conditions are ambiguous themselves, the mandatory disclosure of CSR related information seems to be in a state of inherent legal uncertainty. This might have notable consequences for the disclosures by listed companies. Listed companies also disclose a significant amount of CSR information voluntarily and it might occur that a voluntarily disclosed piece of CSR information proves to be so important for investors that it should have been disclosed mandatorily in the appropriate ongoing periodic disclosure documents. Accordingly, a duty to update the disclosure

documents and to correct the disclosure defect might arise. Moreover, a company might even incur liability for a disclosure defect under certain circumstances.

The present paper, following the detailed investigation and discussion of the CSR disclosure requirements for listed companies in the EU and the US, discusses whether it is possible to predict accurately if a certain piece of such non-financial information as CSR information is mandatory to disclose and compares the EU and US disclosure regimes in this respect. Comparing the EU regime with the US regime is an obvious choice, since the US, due to its mature regulatory system and market size, is regarded as a raw model for financial market regulation ([Ferran, 2004](#)). Hence, the present paper also discusses what the EU regime could learn from the US regime.

2. Reporting requirements of listed companies in respect of CSR-related information

Before the discussion of the US and the EU corporate disclosure systems for listed companies, a brief discussion on the content of the notion of CSR and CSR related information is necessary. CSR may include a wide variety of issues and themes ([Lambooy and van Vliet, 2008](#)), thus, without delimitation, what is understood as 'CSR related information' might be virtually endless.

Many international organization, legislator and industry association define CSR as a purely voluntary effort on part of the companies. The European Commission, for example, defines CSR as "a concept whereby companies integrate social and environmental concerns into their business operations and in their interaction with their stakeholders on a voluntary basis" ([EU Commission, 2011](#)). This voluntary approach is under siege from both different societal groups and the academia, who urge mandating the issues in the scope of CSR to a smaller or larger extent ([Sjåfjell, 2010](#)). In support of the later view others draw attention to the fact that several issues within the scope of CSR are already regulated ([Lambooy and van Vliet, 2008](#)). Therefore, CSR reports usually also include compliance with legal provisions regulating company behaviour in respect of a CSR.

Both sides agree that CSR issues are related to activities the companies undertake in respect to environment and society. CSR information is then information on a company's CSR activities it voluntarily or mandatorily undertakes. As set forth above, CSR is widely accepted to cover social and environmental concerns ([EU Commission, 2011](#)). For the purposes of the present article CSR information related to the environment shall be understood as company activities or a lack thereof aimed at environmental protection and climate change mitigation. While CSR information related to social concerns shall be understood as company activities or a lack thereof aimed at ethical business and fair trade, fair employment and good employee relations, and support of local communities. As CSR information, for the purposes of the present article, also includes compliance with regulations, information on the compliance with future laws shall also be included in the term CSR information.

2.1. The US CSR disclosure regime

To date, there is no comprehensive CSR disclosure regime for listed companies in the US. The disclosure of certain CSR related information is required within the framework of the financial and non-financial

disclosure regime established by the Securities Act of 1933 and Exchange Act of 1934. From the above noted CSR issues, the US authorities mandate only the disclosure of certain information related to the environment and climate change. The rules most relevant to the disclosure of the aforementioned issues are incorporated in Regulation S-K, promulgated by the Securities Act of 1933, since disclosure according to several line items thereof may convey environmental and climate change related information.

Item 101 requires the disclosure of a company's business in general and material costs of complying with environmental laws. This line item might be highly relevant in respect of the mandatory disclosure of CSR information, since it requires the disclosure of the cost and methods of a company's compliance with environmental laws. Item 103 requires the disclosure of any material legal proceedings in progress against the company. It might also be relevant from the perspective of the disclosure of CSR information, since it might reveal legal proceedings started for non-compliance with CSR related legal regulations, such as anti-bribery or environmental protection. Item 303 prescribes the disclosure of the Management's Discussion and Analysis of Financial Condition and Result of Operations (MD&A), which might be the most relevant line item in respect CSR information, since it requires the disclosure of any trends, events, demands, commitments and uncertainties that are reasonably likely to have a material effect on the company's financial condition and performance (SEC, 2010). Under this item companies may have to disclose how they are addressing such trends as the rise of a social demand for socially and environmentally responsible company conduct and how they are planning to address future change in legislation in this respect. Item 503 requires the disclosures of the risk factors relevant to a company which make an investment in that company speculative or risky (SEC, 2010). This item may also concern CSR information, since companies may have to disclose how their operations might be affected by changes, such as new legislation, international accords and indirect consequences of business trends (SEC, 2010), in connection with CSR related issues and how they are addressing these risks.

In addition to the above listed line items, the US disclosure regime contains a general disclosure rule for further material information necessary to make the other specifically required statements of the company not misleading (*Securities Act of 1933, 17 CFR 230.408, Exchange Act of 1934, 17 CFR 240.12b-20*). Accordingly, any further CSR information may be required to be disclosed, provided it is material and needed to provide fair and not misleading review of a company's operations.

It can be concluded that the US disclosure regime may require the disclosure of CSR information, especially environmental and climate change information, in several parts thereof, but not in a coherent and consistent manner. This does not mean that companies have to make extremely long disclosures of their CSR related activities. The SEC has already expressed that it does not require the disclosure of unnecessarily detailed information (SEC, 2003). As can be seen from the aforementioned disclosure rules, the necessity of the disclosures based thereon is tied to the notion of materiality. Nevertheless, there is no rule in securities law to disclose information only because it is material – disclosure of material information is only required if there is an affirmative duty to disclose (Cox et al., 1997). In respect of the noted line items and the general disclosure requirement this statement seems to be true vice versa as well. Even though there are requirements for disclosure of CSR related information under the US regime, a duty to disclose only arises if the information is material as well. Thus the notion of materiality has to be discussed further below.

2.2. The EU CSR disclosure regime

Similarly to the US, the EU does not have a dedicated comprehensive CSR disclosure regime either, and the CSR related information is mandated to be disclosed within the already existing framework of financial and non-financial disclosure. According to the Transparency Directive (*Directive 2004/109/EC of the European Parliament and of the Council of 15 December 2004, Article 4(5)*), which regulates the ongoing disclosure of listed companies, the annual report of listed companies has to be drawn up in accordance with the provisions of the accounting directives. And by the virtue of Directive 2003/51/EC (Modernisation Directive) modifying the company law directives on annual accounts (*Fourth Council Directive 78/660/EEC of 25 July 1978, Seventh Council Directive 83/349/EEC of 13 June 1983*), the aforementioned provisions of the EU regime now require the disclosure of certain non-financial key performance indicators, including environmental and employee matters in the annual report of listed companies (*Directive 2003/51/EC of the European Parliament and of the Council of 18 June 2003: Article 1(14)(a) and Article 2(10)(a)*). Thus, seemingly the EU regime requires the disclosure of more CSR related information than the US regime; however, the EU regime suffers from shortcomings of its own.

Unlike the Regulation S-K, the Modernisation Directive does not contain further specification of what is to be understood under the term ‘non-financial key performance indicators’ and ‘environmental and employee matters’, and which specific pieces of information are to be disclosed according to the Directive. Thus this requirement resembles the above described general disclosure requirement of the US disclosure system. Unfortunately, to date, there are no specific guide lines on what is to be understood under the term non-financial key performance indicators.

Regarding the scope of the disclosure of environmental matters the Commission might provide some guidance (*Commission Recommendation 2001/453/EC of 30 May 2001*). Although not binding, the Recommendation suggests the disclosure of the policies and programmes that have been adopted by companies in respect of environmental protection, the improvements that have been made in key areas of environmental protection, and the extent to which environmental protection measures have been implemented or are being implemented (*Commission Recommendation 2001/453/EC of 30 May 2001, Annex 4(2)(a)-(c)*). Thus, the Recommendation seems to suggest the disclosure of a wide variety of CSR related information, similarly to the line items of Regulation S-K. However, due to the fact that the Recommendation is non-binding, companies may deviate from the guidelines laid down therein.

As for employee matters, not even such recommendation or other guideline exists. However, it is suggested that the term should be interpreted broadly and may refer to such issues as “health and safety, human rights, schooling, education and career perspectives” (*Lambooy and van Vliet, 2008*). Nevertheless, the scope of the term employee matters is even less clear than that of the environmental matters.

Given the foregoing, it might be stated that the Modernisation Directive mandates the disclosure of certain CSR related information. But it does not require an unlimited disclosure. The Directive provides an additional condition: the non-financial key performance indicators have to be disclosed only “to the extent necessary for an understanding of the company's development, performance or position” (*Directive 2003/51/EC of the European Parliament and of the Council of 18 June 2003: Article 1(14)(a) and Article 2(10)(a)*) in line with the requirement of giving a fair review of the company's development

and performance (*Directive 2003/51/EC of the European Parliament and of the Council of 18 June 2003: Article 1(14)(a) and Article 2(10)(a)*). This condition resembles the materiality threshold set by the US regime in order to avoid the disclosure of unnecessarily detailed or irrelevant information ([SEC, 2003](#)). However, it is unclear whether it can be stated that the EU regime also operates with the notion of materiality. An indication of this is found in the fact that the Recommendation expressly refers to the term materiality and recommends the disclosure of environmental issues only to the extent that they are material to the financial performance or the financial position of the company (*Commission Recommendation 2001/453/EC of 30 May 2001, Annex 4(1)*). Additionally the notion of materiality is not alien to EU law, as the Market Abuse Directive defines materiality or price-sensitivity of information (*Directive 2003/6/EC of the European Parliament and of the Council of 28 January 2003, Article 1(1)*), although for the purpose of insider trading. Thus, it might be stated that the EU regime operates with a similar condition to that of the materiality threshold in the US.

3. Analysis of the concept of materiality

According to the above unfolded characteristics of the US and the EU disclosure regimes it might be stated that materiality or a similar concept plays a significant role in distinguishing between CSR related information that is mandatory to disclose and other CSR related information, the disclosure of which is not mandatory. Thus, the concept of materiality seems to be of utmost importance in both regimes, since it acts as a 'valve' protecting investors, shareholders and other stakeholders from being under informed, on the one hand, or overloaded by information, on the other hand. At the same time, it is a widely recognized fact that the doctrine of materiality is a rather ambiguous one ([Westbrook, 2011](#)). Thus, providing a practically applicable definition of materiality is not an easy task, especially if non-financial information is at question. This is underpinned by the fact that the US disclosure regime is still struggling with the determination thereof since the '70s ([Redwood, 1992](#)) and that the Global Reporting Initiative project devotes a full working group at defining materiality for the purpose of sustainability reporting ([GRI, 2011](#)). Thus, it has to be further analyzed where the borderline between material and immaterial CSR related information lies under the US and the EU disclosure systems. The similarities and differences between the two regimes are also discussed with the aim of exploring what lessons the US regime has for its EU counterpart.

3.1. Materiality rules in the US with special attention to CSR information

3.1.1. The development of the concept of materiality

Under the US regime the assessment of materiality is a normative judgment which is a mixed question of law and fact ([Cox et al., 1997](#)), since the assessment of materiality is highly dependent on the circumstances of individual cases ([Hazen, 1995](#)). In one of the early cases, material information was defined as information that a reasonable investor might consider important (*Mills v. Electric Auto-Lite Co.* [1970] 396 U.S. 375). By such a broad definition the US Supreme Court has significantly "muddied the waters" ([Cox et al., 1997](#)) of the US disclosure regime, since according to this the reporting companies, in theory, had to make an assessment of what a reasonable investor considers important.

The decision laid down the path for a materiality standard, which might mandate the disclosure of a wide variety of issues deemed important by reasonable investors, including CSR related issues.

Six years later this broad concept was further explained and narrowed down by the Supreme Court (*TSC Industries, Inc. v. Northway, Inc.* [1976] 426 U.S. 438). This judgment stipulated that the omitted information was “material if there is a substantial likelihood that a reasonable shareholder would consider it important in deciding how to vote” (*TSC Industries, Inc. v. Northway, Inc.* [1976] 426 U.S. 438). The aforementioned ‘substantial likelihood’ means that the disclosure of the omitted information would have “significantly altered the total mix of information made available” (*TSC Industries, Inc. v. Northway, Inc.* [1976] 426 U.S. 438). Thus, it seems that the materiality of a piece of information is not only dependent on an objective definition, but it is also highly context dependent, since it depends on the notion of the reasonable investor or shareholder, which changes over time (Redwood, 1992), and on what kind of information has already been publicly available.

As the final piece of the ‘materiality puzzle’, the US Supreme Court clarified how the *TSC* materiality standard can be utilized in relation to the disclosure of speculative information (*Basic, Inc. v. Levinson* [1988] 485 U.S.224). The judgment stipulated that the materiality of speculative information, such as the occurrence of preliminary merger negotiations, is dependent on the probability of the occurrence of the event and the anticipated magnitude of the event (*Basic, Inc. v. Levinson* [1988] 485 U.S.239). This probability/magnitude test may also be of utmost importance in relation to the assessment of the materiality of CSR information, since much of the CSR information is concerned with future trends and upcoming legislative developments. In addition, the *Basic Inc.* case concerns the sale of shares by shareholders of Basic Inc. on basis of an alleged disclosure defect (Cox et al., 1997). Thus, the judgment seems to extend the standard of materiality, without explicit justification, from voting decisions to trading decisions as well: that is, to decisions of investors or shareholders whether to hold, buy or sell shares (Oesterle, 2011).

It is apparent from the above description of the *TSC/Basic* standard of materiality that it aims to be an objective standard and set a high threshold of materiality, but is also highly context dependent (Sachs, 2006). Thus, in order to analyze the possible materiality of CSR related information, the mentioned elements of materiality have to be further analyzed to investigate if this objective standard can be applied to CSR information, if the CSR information can cross the high threshold of materiality and how the context dependence can affect the materiality of CSR information.

3.1.2. The elements of materiality

3.1.2.1. *The reasonable investor, the reasonable shareholder and CSR information*

The first apparent characteristic of the materiality definition is that it uses the terms ‘reasonable shareholder’ and ‘reasonable investor’, not simply the term ‘reasonable person’. This seems to imply that the definition covers reasonable persons who also have a grasp of the market fundamentals. By default this means a higher bar than a reasonable person test. Arguably a reasonable investor, being aware of market fundamentals, would focus on the financial information disclosure to a greater extent than a reasonable person. Accordingly, the reasonable investor standard seems to create a rather high threshold for the materiality of non-financial information.

The next discrepancy we encounter is that it is unclear whether the materiality standard is based on information that affects or would have affected the *voting decision* of a reasonable shareholder or on information that affects or would have affected the *investment decision* of a reasonable investor. It is quite obvious that there are significant differences between the materiality of information in the voting and the trading context (Oesterle, 2011). Voting is a collective act of the shareholders, thus an actual voting outcome is not changed on basis of certain information unless the majority of the shareholders have regarded the information as important in the total mix of information. In the trading context, if an investor regarded certain information as important might have an influence on his individual investment decision. Accordingly, the test of materiality in the voting context might be more stringent than in the trading context (Oesterle, 2011). This difference might be rather significant in relation to the materiality of CSR information, being seldom relevant in voting, but, at least for some investors, being more likely relevant for investment decisions.

As set forth above, the Supreme Court extended materiality from voting decisions to trading decisions, and the subsequent case law has endorsed this extension (Oesterle, 2011). Accordingly, the same definition applies to both contexts. This could lead to the above discussed discrepancy due to the differences of the two contexts and might mean that there is actually not one objective materiality standard, but more tailored and subjective materiality standards. The SEC and the judicial decisions seem to tackle this problem by viewing the reasonable investor or reasonable shareholder standard as being concerned with the needs and concerns of an 'average investor' and an 'average shareholder' (Redwood, 1992). Moreover, average investors seem to be perceived by the SEC as conservative traders (*SEC v. Texas Gulf Sulphur Co.* [1968] 401 F.2d 833, 849). And although it has been suggested by different authors that CSR is beneficial for a company's profitability (van Beurden and Gössling, 2008), this relationship is similarly disputed (Jones et al., 2008). Therefore, it is likely that a conservative reasonable investor would only be interested in CSR information if it had direct impact on the financial situation of the company.

The concepts of reasonable investor and shareholder are constantly changing (Redwood, 1992). Thus, it should be possible to change the materiality standard as the needs and concerns of reasonable investors and shareholders change (Sachs, 2006). Such a shift has occurred in the SEC's view on the reasonable investor in respect of the materiality of Corporate Governance information (Cox et al., 2009). It appears to be possible that in time a wider range of CSR related information will be regarded as material by the SEC as these issues become important for a majority of the investors and shareholders. However, there is no indication on how many investors need to consider the information important (Redwood, 1992). Since 1995, socially responsible investment grew from USD 639 billion (Social Investment Forum, 1995) to USD 3,07 trillion by 2010 in the US alone (Social Investment Forum, 2010). This is a significant growth, but socially responsible investment represents only 12,2 percent of the US market of professionally managed investments (Social Investment Forum, 2010). At this point it is hard to argue that all CSR information may be regarded as material, since only one in eight investors would consider it important.

It has to be noted that, as a result of the above outlined practice, the SEC and the entire corporate disclosure system has been under constant criticism. Good examples might be the demand for enhanced disclosure of certain Corporate Governance matters (Redwood, 1992) and the demand for disclosure about the companies' business ties to unstable and internationally sanctioned countries (Westbrook,

2011). More fundamental criticisms have also been formulated in respect of the entire corporate disclosure system. It has been argued that the SEC neglects part of its mandate, namely, its mandate to oblige disclosure in the public interest (Redwood, 1992). It has also been pointed out that the high reliance on the financial information disclosures presumes sound accounting and efficient markets, both of which have been called in question by the corporate scandals of the early 2000s and subsequent financial crisis (Westbrook, 2011). Furthermore, it has been noted that the SEC's understanding of materiality might undermine other governmental policies, for example in respect of sanctions against other countries (Westbrook, 2011). It is apparent that these criticisms have a merit in respect of CSR related information as well, since regarding CSR information as material could be in the public interest, it could increase the transparency of the companies in respect of non-financial information and could also support governmental agendas in the US.

3.1.2.2 *The interpretation of the 'might consider important' condition and CSR information*

At first sight, it is unsure whether the wording in the *Mills* and the *TSC Industries* cases mean that the voting of the shareholder or the trading of the investor has to change in order for a piece of information to be material. In the *Mills* case the Supreme Court held that materiality did not mean that the information in question would have had a decisive effect on the voting (Oesterle, 2011). Accordingly, the threshold of materiality seems to have been left very low, since the materiality of virtually any piece of information could have been argued for, even if it had not altered the actual voting decision. This is especially true in light of the fact that it is hard to imagine any kind of potentially relevant information, which would not be held 'important enough' by a reasonable investor or shareholder to be disclosed before undertaking a voting decision (Oesterle, 2011). The judgment in the subsequent *TSC Industries* case retained this peculiarity of the *Mills* case and tried to define 'important' without referring to the actual outcome of the voting decision. According to the judgment, an important piece of information means a piece of non-trivial information that would have assumed an actual significance in the deliberations of a reasonable investor or shareholder (*TSC Industries, Inc. v. Northway, Inc.* [1976] 426 U.S. 438). With such a low threshold a wider variety of CSR information could be regarded as material than as discussed above. However, subsequent cases show that the actual holding of facts does not correspond with the noted wording (Oesterle, 2011), since the threshold seem to be significantly higher in practice. As a consequence, it might be harder to regard CSR related information as material and it might be more difficult for companies to make an accurate assessment of materiality and make a decision whether to disclose specific CSR information through the mandatory disclosure channels.

3.1.2.3 *Total mix of information and CSR information*

Being aware of the above described difficulty of the materiality assessment, the *TSC Industries* case provides for a supplementary definition of what might be considered important by the reasonable investor. Curiously, this subsidiary standard seems to be cited more often in practice than the importance of information test described above (Oesterle, 2011). This might be due to the higher objective quality of this standard, since it does not inquire what the reasonable investor might find important, which, as set forth above, makes the preceding materiality test rather complicated and

ambiguous. Further, the popularity might be attributable to the fact that in this test post disclosure market price changes can be used as objective preliminary indicators of materiality (Cox et al., 1997).

It has to be noted that all disclosed information changes the total mix of information made available. Thus, the total mix of information made available has to be 'significantly altered'. It can be argued that market price changes due to post disclosure or correction can indicate significant change in the total mix of information, but it is unsure whether all CSR information could significantly alter the total mix of information. Arguably, in case of disclosure of significant CSR related litigations or the enactment of CSR related legal regulations affecting the company's operations, disclosure of the CSR information might alter the total mix of information significantly, since such disclosures might also affect the market prices. However, it is hard to argue that other CSR information would clearly significantly alter the total mix of information.

At first sight, a decision of the Second Circuit Court seems to oppose the above statement (*United Paperworkers International Union v. International Paper Company* [1993] 985 F.2d 1190), since it holds the company's claim stating that the company has adequately addressed the environmental concerns related to its operations a material misstatement (Cox et al., 1997). Thus, it would seem that under the right circumstances all CSR related information can be material. However, it has to be noted that the company's claim was held a material misstatement because the company was involved in several environmental litigations, has already pleaded guilty in several of them and agreed to pay substantial fines (Cox et al., 1997). Accordingly, the CSR information disclosure defect was related exactly to the above mentioned situations in which the change in the total mix of information and materiality may more easily be argued for. Another peculiarity of the case is that only the proxy statement contained the misstatement; both the 10-K report and public press reports reported on the realities of the company's environmental conduct. At the same time, the court stated that from all the disclosures it could have been reasonably concluded that the environmental violations were minor and the litigations insignificant (Cox et al., 1997). From the decision it would seem that the total mix of information might also be significantly altered by a certain piece of information, even if contrary information has already been made public. This seems to make it even more ambiguous to answer the question whether CSR related information might alter the total mix of information significantly. However, the disclosure of CSR information may in some cases affect the total mix of information significantly; for example, companies with strong CSR profile disclosing great amount of CSR information may fall within the scope of the standard.

3.1.2.4 Circumstances rendering the information immaterial

The materiality of CSR related information is difficult to assess accurately. At the same time, in certain circumstances it seems much easier to establish the immateriality of CSR related information. The immateriality of CSR information would mean that a company can choose whether to disclose a piece of information in the periodic disclosure documents, in other non-mandatory disclosure documents or do not disclose it at all. Thus, these circumstances and their importance in relation to CSR information is explored briefly below.

According to common law tradition, vague statements, extremely contingent or speculative possibilities are immaterial as a matter of law (Hazen, 2006). Similarly, some degree of puffing and sales talk has been regarded as immaterial (Hazen, 2006). These circumstances may have huge significance in

respect of the materiality of CSR related information, since it has been suggested that CSR related information is frequently represented as marketing or greenwashing material, consisting of vague, speculative statements and puffery (Sjåfjell, 2010). Accordingly, due to such legal practice, much of the CSR information, may be rendered immaterial.

Similar rule applies to the disclosure of forward-looking information. The Private Securities Litigation Reform Act of 1995 creates a safe harbour for companies for disclosing forward-looking information and predictions to investors (*Private Securities Litigation Reform Act of 1995, Pub. L. 104-67, 109 Stat. 737*). This safe harbour is also relevant for CSR information, since much of the CSR related information concerns future intentions of companies and future predictions about their legal environment and operations. Thus, such CSR information might also be found immaterial.

The last circumstance rendering information immaterial is the 'bespeak caution doctrine' (Hazen, 2006). This doctrine is connected to the above discussed circumstances and holds that sufficient use of cautionary language can render information immaterial (Hazen, 2006). It is also a characteristic of CSR disclosure that the language used is rather cautionary. Thus, it might be stated that certain pieces of CSR information may be rendered immaterial by this doctrine as well.

3.2. Disclosure of CSR information in the EU

As set forth above, the Modernisation Directive's CSR related disclosure requirement resembles the general disclosure requirement of the US disclosure system. The provision requires the disclosure of non-financial performance indicators of companies, especially information on environmental and employee matters (*Directive 2003/51/EC of the European Parliament and of the Council of 18 June 2003: Article 1(14)(a) and Article 2(10)(a)*). But the disclosure obligation is not unconditional. In order for a disclosure obligation to arise, the non-financial information needs to be necessary for an understanding of a company's development, performance or position (*Directive 2003/51/EC of the European Parliament and of the Council of 18 June 2003: Article 1(14)(a) and Article 2(10)(a)*). This condition is discussed below in comparison to the US notion of materiality and it is explored what the EU disclosure system can learn from the US system.

3.2.1. The intended audience of the disclosure

Being a vague rule, the provision of the Modernisation Directive does not reflect on who should be able to understand a company's development, performance or position from the disclosure. It is evident that for an ordinary person and an ordinary investor or shareholder different quality and quantity of information is necessary for such an understanding. The quality and quantity of information necessary might even be different within the aforementioned groups.

It might reasonably be argued that, similarly to the US rules, the EU provision also refers to the understanding of shareholders and investors, since in order to satisfy the criterion in relation to a regular person, the companies would have to make extensive disclosures on market fundamentals, which could mean an unreasonable burden on the companies. It has to be noted that in respect of the EU provision, the division of voting and trading decision does not seem to play a role, since, unlike the US definition of materiality, the EU provision does not refer to the importance of a piece of information in

respect to voting or trading decision, but refers to the understanding of the company's development, performance or position.

However, it is unsure whether the Directive infers a notion of reasonable investor or reasonable shareholder or infers a broader stakeholder approach. Arguably, a notion of the reasonable investor and reasonable shareholder, as can be seen in the US disclosure regime, could be beneficial for the EU disclosure system, since it could mean an objective guideline in determining what information needs to be disclosed for the understanding company's development, performance or position and what may be left out. Without such an objective reasonable investor figure the disclosure requirement might become dependent on individual investors' and shareholders' understanding. Thus, it may become rather subjective, with which it is difficult for the companies to comply.

3.2.2. The "necessary for the understanding" condition

The 'necessary for the understanding of the company's development, performance or position' condition of the Modernisation Directive does not seem to resemble the condition of the US disclosure regime, which refers to information that might be considered important (*Mills v. Electric Auto-Lite Co.* [1970] 396 U.S. 375). The EU provision seems to be more subjective than the US regime's materiality definition, since it refers to the understanding of the development, performance or position of a specific company. A reference to companies' development, performance or position in general would be rather ambiguous, since different companies may have very different performances and position and might proceed through a very different development. At the same time, it also has to be acknowledged that by this reference the Modernization Directive may predefine what a reasonable investor should find important.

It might be argued that the CSR related information of individual companies might fulfil this condition in a different manner, depending on whether the information is necessary for the understanding of the company's development, performance or position. For example, for the understanding of the development, performance or position of a company in the green energy industry, CSR related information might be more necessary, than for a company in a classical industry. This solution of CSR disclosure seems to be an advantage in comparison to the US importance of information to a reasonable investor or reasonable shareholder condition, since theoretically, it might serve as a basis for demanding different amount of CSR information disclosure from different companies. This observation seems to be underpinned by the requirement of the Directive providing that the analysis in the Annual Report or the Consolidated Annual report has to be consistent with the size and complexity of the business (*Directive 2003/51/EC of the European Parliament and of the Council of 18 June 2003: Article 1(14)(a) and Article 2(10)(a)*).

Further, the provision of the Modernisation Directive mandates the disclosure of CSR information if it is necessary for either the development or the performance or the position of a company. This wording would seem to suggest that the Directive requires the disclosure of non-financial key performance indicators in order to give a fair review of the past, present and future of the company (*Directive 2003/51/EC of the European Parliament and of the Council of 18 June 2003: Article 1(14)(a) and Article 2(10)(a)*). Accordingly, this provision, depending on the specific company, might mandate the disclosure of a significant amount of CSR related information.

However, without proper interpretation and further elaboration on what kind of information is mandatory to disclose by different kind of companies within the ambit of this provision, it might have

unexpected side effects as well. As set forth above, the US disclosure system's definition of materiality, albeit suffering from ambiguity and unclarity in practice, aims at creating an objective threshold for assessing which information is mandatory to disclose. Due to the vague wording of the EU Directive, companies might be interpreting the provision very differently, which might cause discrepancy in the EU wide interpretation thereof. This might have several consequences. It might be difficult for companies to assess when they have to disclose certain CSR related information. And instead of creating a unified disclosure obligation and comparable disclosure in respect of non-financial key performance indicators, the provision might only increase disclosure obligation without increasing EU-wide transparency, credibility and adequate stakeholder protection in respect of CSR information reporting (EU Commission, 2001).

3.2.3 The total mix of information and the circumstances rendering the information immaterial in the context of the EU provision

At first sight it seems that a tool resembling the total mix of information test is not part of the provision of the Modernisation Directive. A similar statement may be made in respect of circumstances rendering the information immaterial, as that does not seem to have a counterpart in the Directive either. In the opinion of the author hereof, a legal tool similar to the total mix of information test could be useful for the EU CSR disclosure regime. As set forth above, this subsidiary standard of materiality seems to be more successful in the US courts' practice than the importance of information to reasonable investors test (Oesterle, 2011). In addition, this test seems to provide a balance between the shareholders and investors demand for more information and the extra burden what the satisfaction of such would mean for companies. And such a balance could be beneficial for the usage of such general disclosure provisions as the provision of the Directive and in respect of such non-financial information like CSR information.

4. Conclusion

On basis of the above discussions, it can be concluded that while both the US and the EU mandate the disclosure of certain CSR related information, the two regimes have significantly different approaches. Both systems seem to use their financial information disclosure systems as starting point, but while the US is more reliant on the affirmative duty to disclose specific pieces of information interconnected with a materiality threshold, the EU system uses only a general disclosure obligation together with a condition resembling the materiality threshold. Thus, it was concluded above that a materiality threshold or a similar legal criterion plays a significant part in the assessment whether a piece of CSR information is mandatory to disclose or not.

It can be concluded that the assessment of materiality of certain pieces of information is an extremely difficult task, especially in respect of such non-financial information as CSR related information, even in such a mature disclosure system as of the US. While the definition of materiality aims to be objective, it seems to end up being rather vague and ambiguous. A similar conclusion can be drawn about the EU provision as well. Further, the two regimes seem to be operating on basis of the notion of the reasonable investor or shareholder and the importance of the information them. However, while the US materiality definition only refers to the importance of the information to investors, the EU

system seems to define what an investor should consider important. The biggest difference between the two regimes seems to be that while in the US regime, due to being bound to the goal of objectivity and the notion of the average conservative reasonable investor, it is unclear whether the companies' strong CSR profile might render more CSR information material, hence mandate more CSR information disclosure; in the EU regime the subjective focus to an individual company's development, performance or position might do exactly that in case of companies with strong CSR profile. However, it has also been noted that the vague wording and lack of interpretation of the EU provision might also simply cause increase disclosure obligation without actually increasing EU-wide transparency and comparability in respect of CSR information reporting. Under the US regime specific line items help to avoid such an occurrence.

Finally, it has to be noted that a limitation of the present article is that it does not explore the duty to disclose more scattered CSR related information other than environmental and climate change related disclosures in the US and environmental and employee matters in the EU. Such a research would be encouraged in the future. Another limitation of the present article is that it has been focusing only on the Modernisation Directive within the EU regime, as a separate part of the EU disclosure regime for listed companies. In addition, the overall EU disclosure regime's role in CSR information disclosure would merit an investigation as well.

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8. FUTURES METHODS

NEED AND USEFULNESS FOR FUTURE FORESIGHT - ENVIRONMENTAL SCANNING OF THE RESCUE SERVICES IN FINLAND: TREND ANALYSIS AND FUTURE SCENARIOS 2025+

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The Emergency Services College, Finland

ABSTRACT – *This exploration and developing project, sponsored by the Fire Protection Fund and the Emergency Services College, was carried out during spring 2010 in four workshop sessions and in one seminar. The workshop sessions were participated by the Future Foresight Council of Rescue Services in Finland, which is a networking coalition anticipating future changes in Rescue Service's operational environment and having members from the Ministry of Interior, Regional State Administrative Agency, Rescue Departments, The Finnish National Rescue Association and Emergency Services College. The seminar was participated by the Executive Committee of the Forum of the Rescue Services' Administration.*

The central part of the project was the trend and scenario analysis. Earlier, at 2008, the rescue services aimed at understanding the changes of its operational environment through trend analysis and scenario planning. In relation to the updating of the earlier (2008) scenarios of the rescue services the names of the three scenarios (The World of Sustainable Development, The Market Driven World and The World of Closed States and Alliances) were maintained the same in the updated scenario model. Also some fairly clear similarities to the scenarios of the Finnish Business and Policy Forum (EVA) were found although the perspective in these two models is inherently different. Only the scenario name The World of High Capitalism was decided to be changed to The Capitalistic Word in Crisis as it was considered that it would better describe the world for possibly unsuccessful recovery measures after the year 2008's economic recession. Of the four scenarios the two first mentioned were thought to be positive from the perspective of sustainable development and the others two were thought to be negative. Each of these four scenarios was thought to bring their own kind of opportunities and threats to the rescue services of Finland.

Key words: Trends, Scenarios, Strategy, Scenario based strategic work process

1. Introduction

The Finnish society is increasingly shaped by worldwide change, for example the change of climate, population growth, the decreasing amount of natural resources, the globalization of the world economy and on one hand, the disintegration of states and on the other hand, the rise of new super powers. These change factors are such for which also the rescue services must be prepared.

A networking organization which is called Finland's Rescue Services Future Foresight Council was established in 2007 for beginning and keeping up the discussion of the change and future of the operational environment. At the moment the Council has altogether eleven members from the Ministry of the Interior, the Regional State Administrative Agency, the Association of Finnish Local and Regional Authorities, the rescue departments, the Finnish National Rescue Association and the Emergency Services College. The duties of the Council are

- 1) To produce information on the future which helps the parties concerned to prepare for changes by analysing existing information and expert views.
- 2) Make proposals on the kind of evaluation, strategic decision-making and proactive activities needed to achieve the desired state.

An analysis of the operational environment and a scenario process of the rescue services was carried out by the Council in 2008. However, the strategic work that started in 2010 gave reason to re-evaluate the analysis of the operational environment and future scenarios of the rescue services. Also, the events occurring around the world gave reason to a re-evaluation, for example:

- Russia attacking Georgia in August 2008 caused a crisis in international relations and showed that wars with mass armies are still a threat to safety around the world.
- The financial crisis and the global recession in 2008 which seriously disturbed the economical balance also in Finland.
- The ash cloud following the eruption of the volcano Eyjafjallajökull in April in 2010 caused an interruption in the flight traffic in Europe
- etc.

2. NEED FOR FUTURE FORESIGHT: Strategic development challenge

The French American author Anais Ninin has said (Kaunonen June 17th 2010): "we don't see things as they are, we see things as we are". Three filters need to be passed within an organisation before matters have an effect on the decision-making:

1. To pass the discovery filter requires that the decision-makers are aware of what type of and what kind of information is searched.
2. To pass the interpretation filter requires an opinion of what is essential and what is not.
3. To pass the power filter requires a decision on what type of information is included in the decision-making and what is excluded.

Figure 1. presents the factors that affect the future.

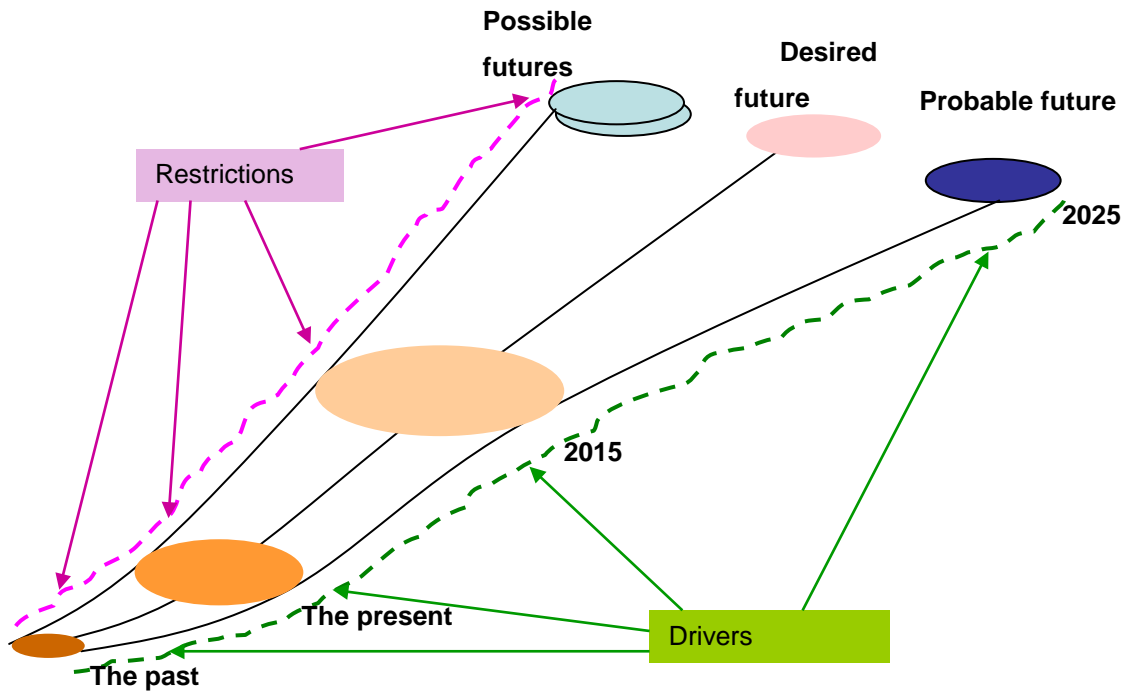


Figure 1. The factors that affect the future

More and more alternative directions of development has to be prepared for and therefore, are more innovative methods for exploring the future, such as scenario work, needed.

3. Classification of Factors of the Operational Environment

In the upper right-hand corner of the fourfold table in figure 2 are located the change factors affecting safety and the rescue services. The change factors are known to be significant but it is uncertain if they will come true and there is sensitiveness for surprise attached to them. In the upper left-hand corner are located the change factors which slightly affect safety and the rescue services at the point of evaluation and which, at the same time, are unlikely to come true. The factors belonging to this category may include weak signals of mega trends or specific threats and possibilities.

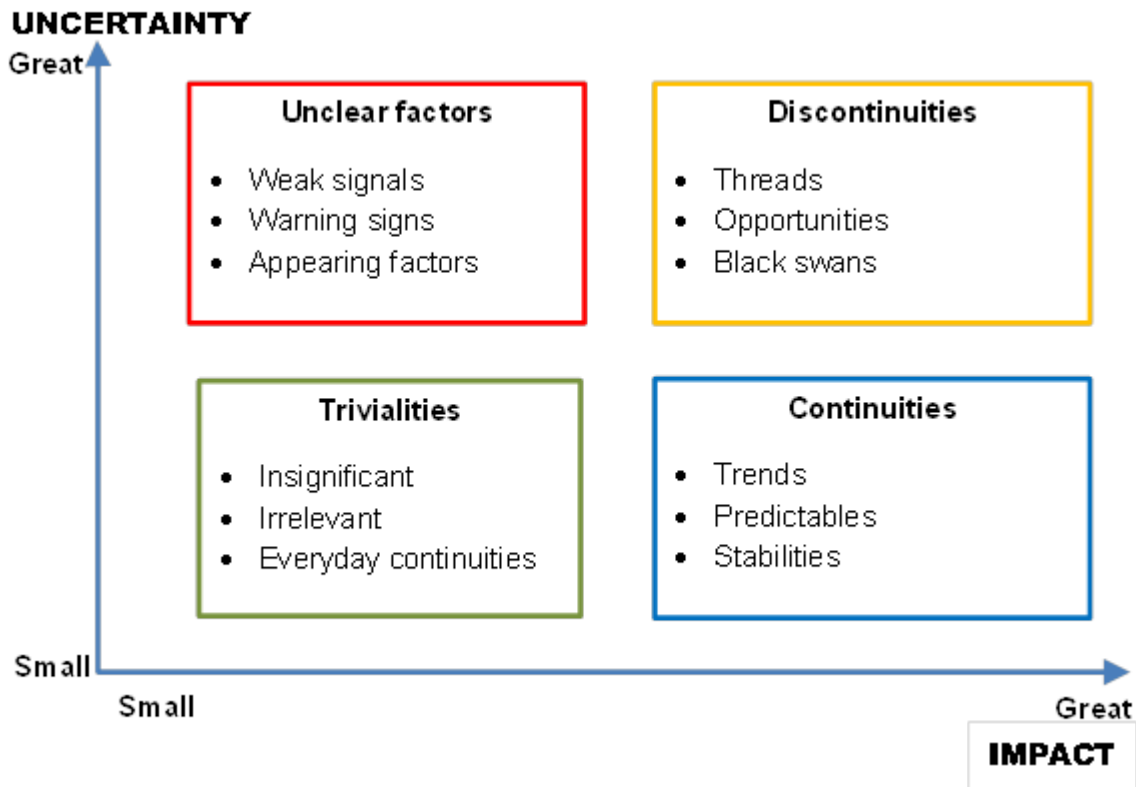


Figure 2. An analysis on effectiveness vs. uncertainty in order to identify the central change factors

In the lower right-hand corner are located the change factors which affect the rescue services and safety little, but the likelihood of coming true is considerable. The change factors belonging to this category are obvious and less attention will be paid to them in the future. In the lower left-hand corner are located trends which affect safety significantly.

4. Trends in the Operational Environment of the Rescue Services

The ageing of the population. Typical accidents of elderly people and rescue missions will increase, and an additional challenge is the ageing of the personnel of the rescue services.

The urbanization development will continue. The need of full-time rescue service personnel increases in the urban centres, but this will create a problem in arranging safety services in sparsely inhabited areas.

The marginalisation and polarisation development continues. Social problems will concentrate on specific groups of people and the differences between people are growing. There will be groups of population that will get by better and better and, accordingly, those who will get by worse and worse. Further, people may more noticeably inherit their social class.

The development of technology will continue. New technology will help to solve problems concerning fires and other safety problems. Then again, in the fields of different technologies (information, nano, bio, nuclear) new and unknown accident risks will arise.

The importance of data networks will grow. The rescue services should keep up with the development by offering services on the net. Through interdependences the vulnerability of the society will increase in abnormal conditions.

The desire for safety and neo-helplessness are emphasized. Fear against new threats will rise and consequently, leads to more safety conscious behaviour. On the other hand, neo-helplessness will increase which also reflects on safety issues.

The demand of energy will increase and the price will rise. The disputes about energy resources and transportation routes might lead to conflicts between states. The rescue services have to participate in saving energy.

The ecological viewpoint and the importance of the environment will increase. The viewpoints of environmental protection must be considered even more in the training of the rescue services and in rescue activities.

The need of skills and innovativeness will strengthen. Also within the rescue services social skills, the abilities to network successfully and lifelong learning will be emphasized.

The competition of skilled persons will grow as well as the foreign work force. The rescue services will more and more have to compete for competent labour force. As immigration increases the rescue services also have to recruit persons with different ethnic backgrounds.

The overload of the public sector and the pressure for efficiency will grow. As a part of the public sector the rescue services function at the same time in the counter pressure of the increasing need of services and modest resources.

Scenarios in the Strategic Planning Process of the Rescue Services

The scenario models connected to the strategic work of the rescue services are presented in figure 3.

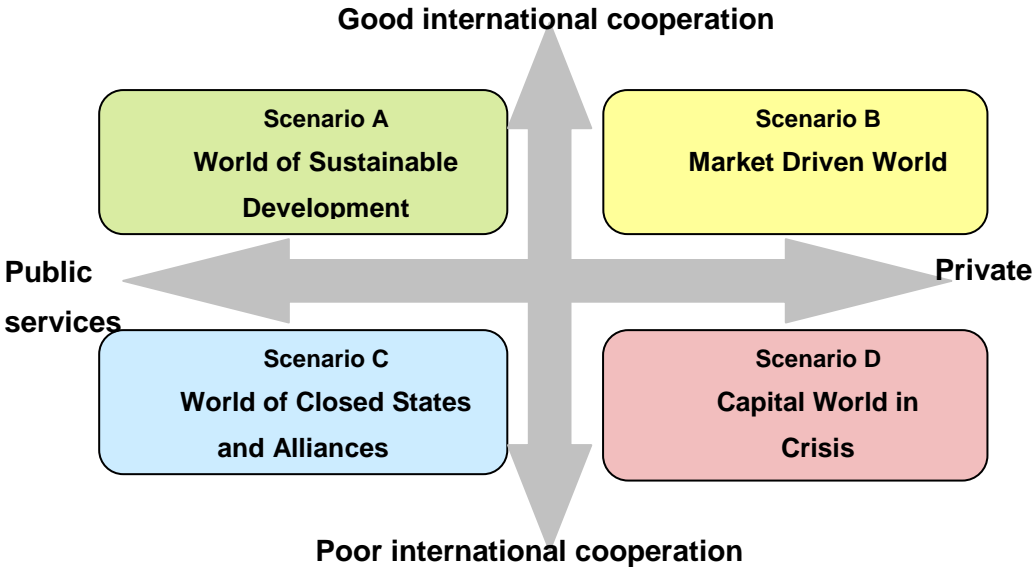


Figure 3. The scenario models connected to the strategic work of the rescue services 2025+

In the following the scenarios are presented shortly with reference to the corresponding broader descriptions in the appendix:

The World of Sustainable Development is directed by multinational laws. A broad based understanding is reached over the necessity of international cooperation and direction concerning the threats connected to the challenges of climate change, the limited resources of energy and nature and the population growth. A global sense of community has arisen as well as a strong awareness of environmental issues. This, in turn, has led to norms minimizing CO² emission (will smoke saunas be forbidden?) although, some difficulties to adapt to multinational direction and bureaucracy on national or local levels also seem to exist. As the international cooperation has improved, military confrontations have decreased. The growing environmental awareness among citizens has led to a more balanced development between rural and urban areas in Finland. The rescue services are guided by multinational norms and direction, and their duties have also clearly expanded towards the direction of prevention and environmental protection.

The Market Driven World is directed by the market forces. The global economy is growing with China and other developing countries in the lead. In comparison to other economic areas Europe has somewhat declined. A strongly networked and enlightened global consumer movement has reached an important role as a counterweight to market forces. With consumer behaviour and global boycotts the production is also forced into a more ethically and ecologically sustainable direction. The values emphasizing individuality have in some extent hardened which has slightly led to social inequality and to the division of wealthy and less wealthy people. Insurances have an important role for communities and private households in risk management. Also, international crime has gained hold in the economic life. This development has led to a strong urbanization. In Finland there is only one metropolis and the continually declining rural areas. The rescue services are supervised by the public sector but it is administered as international business mainly with the high profit requirements of a private company.

The World of Closed States and Alliances is a consequence of regional business blocs, protectionism and the rise of state capitalism. The political and military confrontations have increased around the world. Russia and the EU are in an unfavourable alliance as Russia needs European technology and the EU, in turn, needs more alternatives to solve its energy issues. Finland's position as a country dependent on import of energy is uncertain, but as the cooperation between EU and Russia strengthen on the Baltic Sea area Finland's importance may grow. A restricted development of international safety matters has led to a strong national direction. In Finland the society carries the responsibility, but with less economical resources as the economy weakens. Respectively, a local sense of community arises along with a real caring for each other. The rescue services together with other actors in the safety field are administered by central public direction also including first response and emergency medical transportations. The importance of civil defence is emphasized.

The Capitalistic World in Crisis steals the attention of different parties concerned from the whole and leads them to concentrate only in their own business. The traditional recovery procedures have not been successful in the global economic crisis. This results in a prolonged low economic growth and a world of collapsing states where insecurity prevails and crime thrives. Also in Finland has the safety nets failed along with limited economical means – as a consequence, the welfare state collapses. Wealth has concentrated on few and the wealthy take care of their safety independently. A large group of poor people living in the city slums have to look after themselves. The uncontrollable and unwanted

flood of environmental immigrants cannot be stopped. Finland is becoming multicultural, but the development is uncontrolled and unwelcomed by the Finns. There are a strong tension between the immigrants and the Finns. The low public funding requires a reorganizing of the rescue services.

During the scenario process the target of interest turned to the four alternative descriptions of the Finnish Business and Policy Forum (EVA) published in a report in 2009 of how the world might develop in consequence to the economic crisis (figure 4).

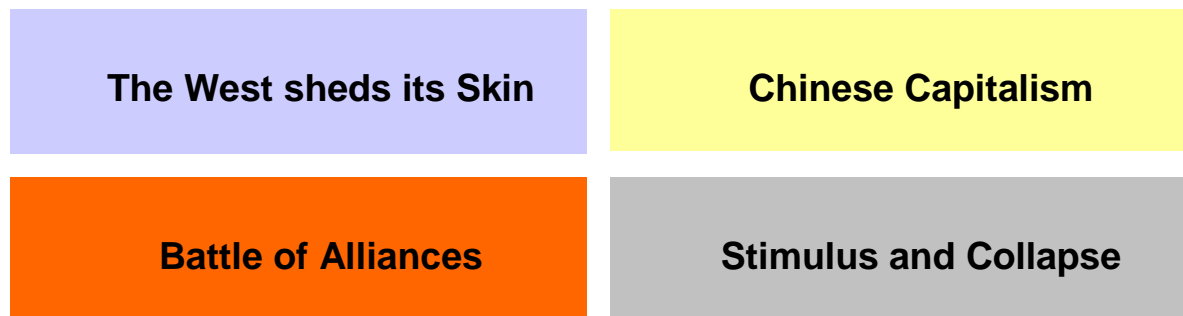


Figure 4. The four scenarios of EVA (EVA 2009, 8)

In the scenario *The West sheds its Skin* the western countries quickly recover from the economic crisis with the USA on the lead. In 2020 the world is still led by the USA and Europe but not on the terms of the western countries. Finland recovers from the economic recession with relatively minor damages. After the crisis the world economy will develop in the same direction as in the beginning of the 2000s. The problems will not disappear, but the challenges and the possibilities are of the same type as before the economic crisis. (EVA 2009, 45–46.)

In the scenario *Chinese Capitalism* Asia will recover faster than the western countries from the economic crisis with China and other rising economies on the lead. In 2020 the focus of the economy is shifting towards Asia and the wealthy OPEC countries in the Middle East. In this scenario Finland might succeed extremely well or extremely poorly. The world economy grows quickly but the economic and political focus has shifted to Asia. This means that Finland is forced to a considerable structural change. (EVA 2009, 46–47.)

In the scenario *Battle of the Alliances* the economic crisis leads to a deep global recession. The economic nationalism and the rise of state capitalism lead to a battle between different economic areas. The world will recover slowly from the recession. Finland with its export driven economy will have considerable difficulties. Fortunately the inner markets of the EU and the Russian market are booming. When the cooperation between the EU and Russia strengthens, Finland might have an important position on the Baltic Sea area. (EVA 2009, 49–50.)

In the scenario *Stimulus and Collapse* the world will dive into a prolonged period of low economic growth. After unsuccessful attempts of economic recovery measures taken the economic system will collapse and by 2020 the world is on adrift without a clear leader. The economic life in Finland is divided to serve the domestic market and the demand for international expertise. Finland is forced to significantly reduce public services and public investments. (EVA 2009, 51–52.)

The future scenarios of the rescue services and EVA were compared and the correspondences between the scenario models are presented in figure 5. The scenario *The World of Sustainable*

Development corresponds closest to the EVA scenario *Comeback The West*. The scenario *A Market Driven World* corresponds closest to the EVA scenario *Chinese Capitalism* in which the global economy would rise on the terms of the market forces. The scenario *The World of Closed States and Alliances* corresponds closest to the EVA scenario *Battle of the Alliances*. The scenario *The Capitalistic World in Crisis* corresponds closest to the EVA scenario *Stimulus and Collapse*.

EVA scenarios	Rescue Services scenarios
The West sheds its Skin	World of Sustainable Development
Chinese Capitalism	Market Driven World
Battle of Alliances	World of Closed States and Alliances
Simulus and Collapse	Capitalist World in Crisis

Figure 5. The correspondence of the scenarios of the rescue services (Kaukonen 2008, ed.) and EVA (EVA 2008).

5. THE USEFULNESS OF FUTURE FORESIGHT: Scenario based strategic planning

Figure 6 presents the integration of scenario work as a part of the strategic process.

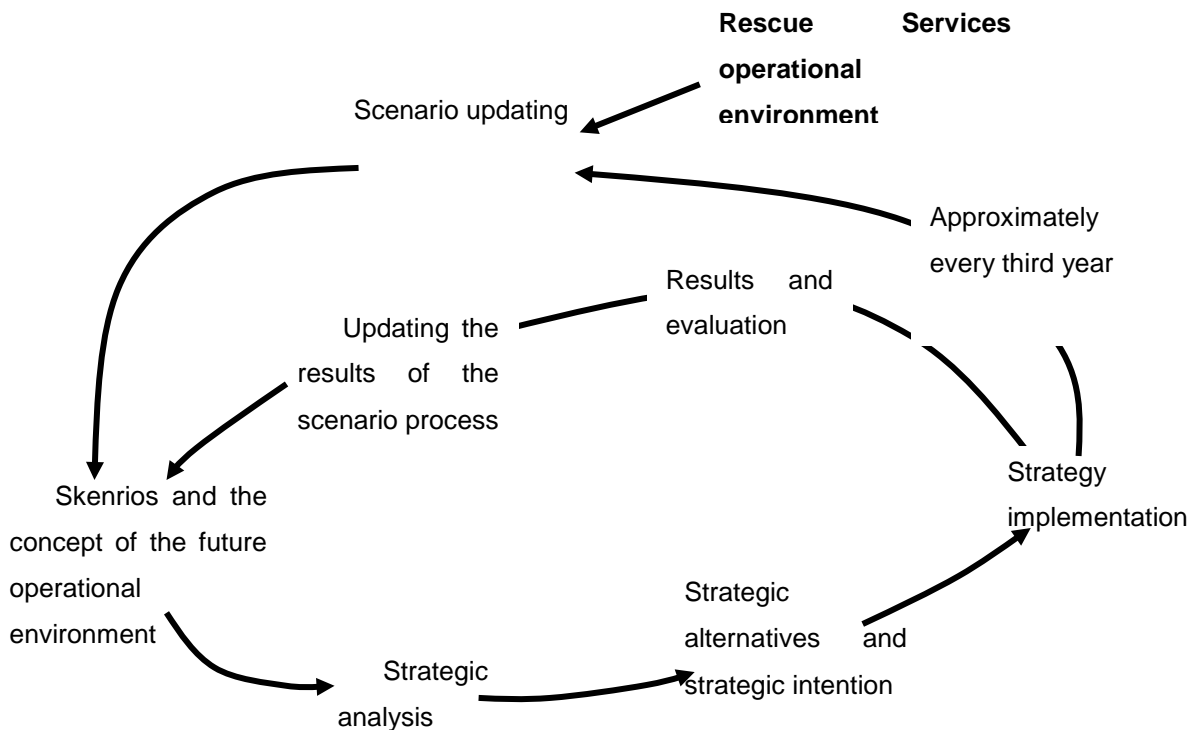


Figure 6. Scenarios integrated as part of the strategic process of the rescue services (The trend and scenario analysis of the rescue services 2010)

Scenario based strategic work is built on the scenario process which aims at creating a joint view of future trends and uncertainties of the operational environment. Further, the task is to develop the future scenarios and estimate their effect in the field. Next, a strategic analysis is carried out in which the effectiveness of the present strategy and the critical success factors of the organisation in the perspective of the results of the scenario work are estimated. On the basis of the analysis are alternative strategic courses of action defined. Correspondently, their effect is estimated in various future scenarios and also, for example, the strategic state of determination is expressed as a vision and as an organisational strategy. The planning phase is followed by the implementation of the strategy and the follow-up of the results which helps to update the results of the scenario work. The strategic work is carried out yearly. At the same time the scenarios and their effects are estimated but the whole process of scenario work with the purpose to improve the scenarios is not necessarily carried out. A strategic process is connected to a scenario project only every three years unless the changes in the operational environment give reason to a shorter period of re-estimation.

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THE SIGNIFICANCE OF WILD CARDS AND WEAK SIGNALS FOR SUSTAINABILITY – CASE OF WATER SERVICES

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ABSTRACT – *This paper describes a study that was conducted to assess weak signals and wild cards for sustainability in the case of water services. It is argued that their potential lies in the practical application, not in scientific strict methodology and rigid interpretations of what weak signals and wild cards are. Thinking about weak signals and wild cards can be an essential part in strategic long-term thinking, help us think differently, and in this way contribute to future sustainability.*

1. Introduction

According to the most widely used definition of sustainable development, originally by the World Commission on Environment and Development, “sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (WCED 1987, 43). Thus, by its very basic definition sustainable development is future-oriented: how can development be sustained in the future. Changes in the environment of different systems can cause risks to the systems and their development, undermining their sustainability in the long-run.

One key issue in promoting sustainable development of a system is how to anticipate future risks and prevent them or try to adapt to them. This, however, is not such a simple issue as sustainable development is dynamic (Newman 2005) and complex in nature. It is dynamic and complex all as it combines the human and natural systems (e.g. Blewitt 2008). As complex systems are filled with uncertainty no amount of precaution will eliminate all the risks. There are different futures research methodologies that can be used to scan the environment and make the system “sensitive to emerging changes as early as possible so that they have better time to react or to be in time to utilize the opportunities of an emerging change” (Hiltunen 2010, 3). Weak signals and wild cards can be considered to manifest a possible change in the future that could jeopardise or promote a system’s sustainability.

In this paper we will examine weak signals and wild cards in the case of sustainability of water supply and sanitation services¹. Water services provide an interesting case as sustainability of these services can be considered to be one of the key issues in human well-being. If something goes wrong, this can compromise significantly the well-being of many as was seen in the water crisis in the Finnish town Nokia in 2007: some 6000 people were taken ill because treated wastewater was accidentally released into the drinking water distribution system. Thus, the question is primarily not about financial losses in case a wild card becomes reality, but it is about human lives and functioning of societies. For that reason, decisions made on water services are typically multi-dimensional. Furthermore, one feature that makes water services different from other services is that it is a natural monopoly (Pietilä et al. 2010). Weak signals and wild cards are not about finding competitive edge in the markets, but about sustaining and ensuring safe services to all.

The water services system can also be described as a relatively static system. In essence, there has not been significant changes in the systems after the adaptation of centralised drinking water distribution or water based sanitation. There have been improvements to the treatment technologies of both raw and wastewater, and the materials and technologies used in piping systems have developed but in the end these changes have not really affected the big picture or the paradigm of water services. Furthermore, the life cycle of water services infrastructure is remarkably long, putting additional pressure on the sustainability of decisions (Katko et al. 2006). The static nature has contributed to the fact that the sector is rather conservative: somewhat resistant to change and slow to embrace new technological innovations. One reason for this can be interpreted to be related to the fact that water services are a natural monopoly. As there has been no need to compete there has been no need for revolutionary changes and innovations in the field. One indication of this conservativeness was a workshop organised in March, by the Finnish Water Forum, in which it was to be discussed how education should be developed to meet the vision for year 2025. It proved obvious that most people working in the water sector were not able to vision that their sector would be somehow different in the future. Instead, they were thinking about very minor changes and improvements even though the facilitator of the workshop tried to encourage them to think innovatively and differently.

Furthermore, water services are a somewhat engineer-oriented sector. As Nafday (2009) argues, engineers are generally dismissive of unpredictable events until they occur because they engineers used to focus on specifics and do not feel comfortable with uncertainty and ambiguity. In addition, Taleb (2007) argues that humans in general focus too narrowly on one's own field of expertise and overestimate one's own knowledge. People tend to underestimate possibility of big changes in the future and overestimate their own capacity to cope with changes.

However, in the future and already today, there are several challenges facing the water services sector and in worst case compromising its sustainability (Heino et al. 2011). In addition, to the identified challenges, there might be some less visible but major changes looming around the corner that could seriously impact the field. According to Dominguez (2008, 9), future uncertainty is increasing in the

¹ We will use the term "water services" to cover both water supply and sanitation services from here onwards. In addition, we choose to discuss "services" to highlight that we are not focusing only on the technical process of producing water services, but there are different stakeholders, customers at the forefront, for whose benefit the service is produced, who can have a significant impact on the services and who must be taken into account. Thus, questions related to the management and governance of water services are central in this paper.

infrastructure sector. Thus, the need for strategic future planning is also highlighted. By identifying and analysing weak signals and wild cards, it is possible to try to anticipate the future changes and try to affect the changes or prepare response strategies to these changes (Hiltunen 2010, 5).

One of our personal motivations to conduct this study was to give a wakeup call to the field. In our opinion, it needs to be better acknowledged that it is not adequate to examine water services only from the technical perspective and in isolation from other activities in society. We, in the field of water services, need to be more sensitive to what is happening elsewhere in society and develop the field systematically. In addition, water services are usually taken for granted. Thus, it is very improbable that the customers of water services consciously would find and report any signals or wild cards so that it is merely a task of us – people working in this sector. As Hiltunen (2010) argues weak signals can help us to break the prevailing mental models, encourage us to think differently, and help us to be more innovative about the futures.

This paper starts by a discussion of the materials and methods used in this study, i.e. discussing what weak signals and wild cards are, how can they identified and analysed, and finally describing the materials used to find weak signals and wild cards. In the following section some examples of results obtained in the identification and analysis of weak signals and wild cards will be introduced. This section, however, is kept rather short as the focus of this paper is to discuss the process and its usefulness, not the specific results. Thus, results are followed by discussion of the actual process, analysis of its weaknesses and strengths. The paper ends by drawing together some key conclusions.

2. Materials and methods

This section first of all covers a short overview of theory on weak signals and wild cards, and methodology related to them. In the end, the material choice of this study is introduced. The theory in relation to this study is covered in more detail under discussion.

Weak signals

Igor Ansoff can be considered as the pioneer of weak signals analysis. He (1982; according to Mendonça et al. 2004, 206) defines weak signals as warnings that are too incomplete to permit an accurate estimation of their impact, and/or to determine a complete response. Later on, Finnish futurists have been active in developing theories and methodologies related to weak signals (e.g. Hiltunen 2010). Based on the literature, however, it is not quite obvious what weak signals are but there are many views that are sometimes even contradictory (see e.g. Moijanen 2003 for an overview). Some use terms 'emerging issues', 'seeds of change', 'wild cards' and 'early warning signals' interchangeably with weak signals (Hiltunen 2010, 57). According to Moijanen (2003), weak signals are generally defined in three ways. First, some consider that weak signal itself is a changing phenomenon that will strengthen in future. Second, some see that weak signals are the cause of new phenomena and changes. Third, some limit weak signals as symptoms or signs that indicate change in the future.

Another issue causing confusion in defining weak signals is the discussion about their objectivity versus subjectivity. According to the objective view weak signals exist as such and are independent of the interpreter. Then again, according to the subjective view weak signal always needs a recipient who

interprets the signal (Moijanen 2003). Rossel (2009, 312) criticises existing literature on weak signals for “neutralising” weak signals, “as if they were objects or features in their own right, waiting to be discovered, instead of considering them as the expression of the paradigmatic capacity of the analyst to organise perception and interpretation in a certain way”. Following the subjective view, interpretation of weak signals depends on the context. Thus, same signal can in one case be interpreted as weak and in another as strong.

Hiltunen (2008a, 249-250) suggests a three-dimensional model of the future sign to clarify the idea of weak signals. The three dimensions are a) the object (emerging issue), b) the representamen (the concrete form that the sign takes, i.e. signal), c) the interpretant (sense made of future potential of the sign). Furthermore, Hiltunen argues that two-dimensions of the sign are objective: object and representamen. These exist as such. Only subjective dimension is interpretation of the sign, as the interpreters make their conclusions about the sign in their own context. (Ibid, 249-253.)

Wild cards

Wild cards have been part of futures research and scenario building since the 1960s. However, it was only in 1996 that an approach to study wild cards came about as John L. Petersen’s book *Out of the Blue: How to Anticipate Big Future Surprises* was published. (Petersen & Steinmüller 2009, 1.) Wild cards are generally defined as rapid, surprising events with huge disastrous, destructive, catastrophic or anomalous consequences. Usually these events take place so rapidly that normal, planned management processes cannot respond to it, making the organisations highly vulnerable. (Hiltunen 2006, 62; Mendonça et al. 2004, 202.) Petersen and Steinmüller (2009, 1-2) argue that in the complex and interconnected world of today, it is now more relevant than ever to study wild cards so that based on the information we could prepare for them, prevent them or in some cases even deliberately provoke them. We should not forget that wild cards can also be beneficial events, whose potential we want to be able to exploit (Ibid).

Some use wild cards as a synonym for weak signals. Hiltunen (2010, 96) however, defines wild cards as events with a huge impact whereas weak signals are signs of events or emerging issues, such as wild cards. Whether or not one consider these two terms as synonyms, depends how one defines weak signals. If one accepts that weak signals can be both events and signs of events, then wild cards and weak signals can be used interchangeably. However, if one thinks that weak signals are not events themselves but indications of them, wild cards and weak signals are not synonyms. Instead, it can be perceived that weak signals precede wild cards. Thus, weak signals can be employed as a means to anticipate wild cards (Ibid, 96; Mendonça et al. 2004, 208).

Wild cards are often confused with gradual change (Hiltunen 2010, 67). Gradual change, like the change from dry toilet to water closet, had a significant impact, but it was not rapid as it was possible to observe the change and adapt to it. In the case of wild cards, there is only little time to react before it takes place (Ibid). An example of wild card could be the Nokia water crisis described in the introduction. There is some disagreement about whether a wild card can be anticipated at all. Petersen and Steinmüller (2009, 4) distinguish three types of wild cards: 1) events that are known and relatively certain to occur but without any certainty as to timing (e.g. the next earthquake), 2) future events that are unknown to the general public (or even the professionals) but that could be discovered if we only

consulted the right experts or if we had adequate models (e.g. impacts of climate change), and 3) intrinsically unknowable future events that no expert has in mind, where we lack concepts and means of observation (unknown unknowns). The last type of wild cards, the unknown unknowns we can only judge by hindsight. Category two wild cards are the ones that we could possibly anticipate and are of interest here.

Mendonça et al. (2004) argue that it is sometimes possible to anticipate wild cards in advance as weak signals of it are available (see also Hiltunen 2010). The question is more about if someone notices these signals and is able to make “correct” interpretations on it. In the case of Nokia water crisis the weak signals were, for example, observations by consumers on the weird appearance of water. Consumers complained about these to the water works, but these weak signals were not taken seriously. It was assumed that foaming of tap water and its weird smell and taste were due to pressure changes in the water distribution network. It was only after two days when people were reporting stomach problems that the issue was taken seriously.¹ If the signals, concerns of people, had been taken seriously and reacted earlier on, it would have been possible to limit the extent of the water epidemic.

Methodology for identifying and analysing weak signals and wild cards

Some methods to analyse weak signals have been developed and can be found in literature. E.g. Ansoff has created a Weak Signal Issue Management System (Weak Signal SIM). Hiltunen (2010, 59), however, argues that the practical use of this approach appears to be very mechanistic as there is no space for creativity and intuition.

According to Schultz (2002, see also Linturi 2003) a basic approach to scan environment for weak signals consists of the following phases: 1) choosing from five to nine information sources, that should be preferably from different sectors and should cover both, specialist and fringe sources, 2) creating a scanning database, including the title, source, description and implications of the signal, 3) evaluating scan “hits”, are they subjectively or objectively new, are they confirming, reinforcing or negating?, and 5) looking for interdependencies, feedback delays and repeating patterns in the scanned data (Ibid, slides 8-10).

Linturi (2003) has developed an online methodology Signalix to hunt down weak signals. Signalix is a comprehensive process consisting of altogether 12 phases. Summarising, this method starts by choosing a problem and describing it (phase 1), next the context of problem is analysed (e.g. analysing the system, trends, values and memes related to the problem (phases 2-6), third part is the actual search for signals, i.e. looking for signals of the chosen meme in sources (phase 7), signals are then analysed by classifying them into strong (trends) and weak and then assessing the signals using e.g. Delfoi (phases 8-9). In the last phases (10-12) the analysed signals are used to create scenarios and a vision, and a system to monitor development systematically.

As weak signals are seen to precede or indicate wild cards, identifying weak signals and interpreting them can produce information on wild cards. Mendonça et al. (2004) can be seen to favour this kind approach. Another possibility is to directly try to identify wild cards and then assess and monitor them

¹ For a detailed description of the Nokia Water Crisis (in Finnish) see Seeck et al. (2008).

by identifying weak signals that could indicate these wild cards. For example, Petersen and Steinmüller (2009) introduce wild cards methodology that starts by identifying wild cards. This can be done by using published lists of wild cards. However, they recommend collecting or inventing wild cards specific to case in question. In the next phase, the identified wild cards are assessed and their amount is narrowed down so that only the ones considered most relevant will be considered in the following phases. The third phase consists of monitoring weak signals of the wild card. Fourth, options for action (to prevent, to prepare for, or to promote wild cards) are discussed.

The method we used in this study does not directly follow any of the ones described above. We were not sure what methodology to use as we were looking to cover weak signals and wild cards in the whole field of water services. This field consists of various heterogeneous actors. Most often weak signal methods have been created for organisations to aid them in anticipating futures, scenario processes and creating their strategies. Our case, however, was quite different. We were not looking to create scenarios or strategies for the whole field, but instead trying to look for signals that the actors in the field could possibly use in their strategy processes. Thus, the methodology that was chosen was quite loose and in a sense, it could be called data-driven. Our choice is supported by Rossel (2009, 318), who argues that weak signal analysis should not be a one-size-fits-all approach, but that the characteristics of the organisation or object of study should influence the way analysis is conducted.

Similarly to Linturi's (2003) Signalix, we started by discussing the possible problems and issues related to water services. Following Coffman (1997) we were discussing about things that just feel funny about our case and things that we see as happening, but cannot really pin them down. In a sense, this phase resembles also the first phase of wild cards methodology: inventing things that could happen (Petersen & Steinmüller 2009, 4-5). Next, we decided on the sources or the material that we will go through (described in the next section) to look for weak signals and started scanning these.

Materials

Hiltunen (2008b) has made a survey study asking futurists what they considered to be good sources of weak signals. In her results, personal connections were empathised and overall favoured sources were scientists/researchers, futurists, colleagues, academic and scientific journals, and reports of research institutes (Ibid, 22). As was discussed in introduction, the water sector is rather conservative. Thus, we felt that it would not be that beneficial to use field experts of their writings as a source. Instead, we chose as our material Finnish newspaper and magazine articles that were not related to water sector directly. In addition, there was other material, like blogs that were found by accident¹. These were used in the first phase when we were trying to scan for interesting issues and problems from outside the water sector that could be used as analogies in the sector. Hiltunen (2008b) also recommends the use of so called peripheral sources (such as arts, science fiction, alternative press, blogs).

We decided to cover a time span of one year of the newspapers and magazines (March 2010 – March 2011). The newspapers chosen were Aamulehti and Lapin Kansa. We did not read all papers published during the year, but focused on papers of 11th and 27th day of each month. Aamulehti is the newspaper of

¹ e.g. Alf Rehn's blog post "Kestävä kehitys ja merkitystalous" <http://alfrehn.posterous.com>

Tampere area and Lapin Kansa is published in northern Finland. These papers were chosen to get a wide geographical view. Magazines chosen were Image and Kuluttaja. Image magazine covers a wide range of phenomena from popular culture to politics, and it can be characterized as a trendsetter. We chose Image as we thought it might offer some fresh perspectives. Kuluttaja magazine is published by the Finnish Consumer Agency and it focuses on reviews of products and services. Kuluttaja was chosen to give perspectives of changes in consumer culture and preferences of people.

3. Results

First, we discussed issues that had puzzled us in the water services sector. One such issue is bottled water. Many water sector experts condemn bottled water as a totally useless, ridiculous and stupid product and downplay people's reasons to choose bottled water over tap water. The markets for bottled water, however, have been rapidly growing. Then again, the biggest challenge in Finnish water services sector is the aging infrastructure and the growing renovation debt (Heino et al. 2011). If we cannot keep up with the needed infrastructure renovation pace because of lack of required resources, the quality of tap water will be endangered at some point. Could one option be to accept lowered quality of tap water and use bottled water for drinking and other purposes requiring higher quality of water? After all, about 95 % of tap water is used for other than drinking and cooking purposes, such as flushing the toilets.

Another issue discussed was water-related crisis – will there be another crisis like the one in Nokia in 2007? What could the reasons be? One possible reason could be the use of various plastic compounds in the distribution networks, such as new epoxy plastics in renovation. There is no knowledge at least on the long term behavior of these products. There have, however, been some worries related to bottled water that some more or less hazardous chemicals would be released from the plastic bottles into water (e.g. Royte 2008, 148). Could plastic water pipes jeopardize people's health in the future? Why would plastic be harmful only as bottle material but not as pipe material? Also, what if it is found out that the plastic pipes are not durable in use and need to be replaced only after few years in use? This would not necessarily compromise people's health directly, but would be a huge financial burden to the water services providers and, after all, to the customers.

Third issue was the role of the customer in water services. In Finland, water services provision is the responsibility of municipalities. Is there a tension between roles of the customer and citizen? Will people trust public services in the future? Will the requirements of people significantly change in the future? Quite many water services experts seem to think that many challenges of the field could be resolved by moving water services further away from political decision-making, i.e. especially that water works would be financially separate from the municipalities. How will this impact water services and people's perception of these services?

Findings of the reading of newspapers and magazine: weak signals and wild cards?

One issue that seemed to rise from scanning the newspaper and magazine articles were customers' changing expectations. Both public and private services need to be convenient and readily available. For example, in Image 9/2010 the chief editor claims that oranges are too inconvenient for modern consumers. Then again, in Aamulehti 11.11.2010 Aila-Liisa Laurila writes under an article about the need

to create a euthanasia law, that older generations were used to be passive objects of services. Younger generations, instead, require more and want to make individual choices about service that will take into consideration their personal values and needs. There was also quite many articles about how we should focus more on the ultimate purpose of services instead and think about what people really expect of the services (these were especially about the health services e.g. Image 3/2011: *Kuka toi kovat arvot Suomeen*; Aamulehti 27.3.2011 *Likainen paita vaihdetaan, eikö niin?*; but also about building: Aamulehti 11.11.2010 *Asiakas unohtuu, kun rakentaja jahtaa kuluja* and private markets, e.g. about Nokia forgetting its customers: Aamulehti 11.9.2010: *Uusi kapteeni, uusi kurssi*). In Lapin Kansa 27.4.2010 (*Apua täytyy antaa niille, joille se lain mukaan kuuluu*) it was demanded that an individual and his or her needs should be the starting point of different public services, not the way these services are organized or minimizing their costs.

Price of different products was also widely covered. E.g. people have not accepted the new E10 fuel and are willing to pay more for the traditional product as they know that it will function properly (Lapin Kansa 11.3.2011: *E10-bensan myynti ei vieläkään suju*).

Another issue is the apprehension about chemicals, or even chemofobia. This was especially visible in the Kuluttaja-magazines reviews about consumer products (e.g. Kuluttaja 3/2010 where prams were tested for hazardous chemicals). People also expect more open information about chemical consistency and additives of different products in understandable way (e.g. Kuluttaja 8/2010: *Suomea kylpyhuoneeseen!*, and Kuluttaja 4/2010: *Kemikaalit esiin, kiitos!*). It seemed that some businesses had already responded to these demands. An example of this is a full-page advertisement by a dairy producer Arla-Ingman on their new margarine *Arla Ingmariini* that is “totally without additives” (Aamulehti 11.3.2011). Chemicals of different consumer products have been a hot topic in online discussions for past years (see e.g. Noora Shingler’s blog “chemical cocktail” kemikaalicocktail.blogspot.com).

A third issue that we found interesting was related political decision-making. First of all, there were some articles about how power has been shifted away from democratically chosen political decision-makers to professional civil servants (e.g. Image 3/2011). For example, in Image 8/2010 (*Populismia islantilaisittain*) the victory of a party that was set-up just as a joke was explained by the frustration of people in the toothless political decision-making in the past. Politicians do not want to make hard decision or discuss values. Aamulehti 11.11.2011 also quoted newspaper Karjalainen that it is about time that the politicians take power and carry their responsibility, they should not anymore hide behind civil servants. There were quite a few articles that called for more open, transparent and participatory decision-making processes. E.g. in Aamulehti (27.11.2010: *Viranomaiskieli usein käsittämätöntä*) there was an article about how the language used by civil servants is incomprehensible to lay people making it impossible for them to follow-up decision-making and take part in it.

There were also some examples of how decision-making processes had been improved. For example, Lapin Kansa (27.9.2010: *Minne mennä –palsta: Keskustellaan kahvin kera kaavoituksesta*) wrote of the civil servants responsible for urban planning and waste management in the town of Rovaniemi, who participate in open coffee meetings with local residents. In these unofficial gatherings people feel easier to ask these civil servants about issues puzzling them, and then again share their personal views. Another issue, quite expectedly, was about utilizing internet and social media in public services. Quite a surprising news was the extent that the Finnish tax authorities are already utilizing blogs and discussion forums in their work (Lapin Kansa 11.7.2010: *Blogit ja nettifoorumit ovat jo verottajankin työkaluja*).

Here are just a few examples of the news that were chosen and analyzed. In the next section, these findings are assessed against theories on weak signals and wild cards.

4. Discussion and assessment of the results

We will start by assessing our findings introduced in previous section. One problem here is, as Hiltunen (2010, 8) points out, that the actual value or worth of weak signals can only be judged with hindsight. The same can be said to apply also to wild cards. We cannot know if our interpretations are correct or useful to the water services sector. Thus, we will try to assess our findings against theories on weak signals and wild cards.

First of all, the reliability of findings depends on the resources or materials used. According to Hiltunen (2010, 104) weak signals can be divided into primary and secondary exosignals. Primary signals are directly connected to an emerging issue and are, for example, visual observations of the issue. When primary signals are interpreted and presented e.g. in news papers, they turn into secondary signals. Hiltunen (2010, 104) warns that there is a risk with secondary signals being distorted or even fictitious. Probably one of the biggest weaknesses in this study was the material chosen. As we used mainly newspapers and magazines, we have to rely on secondary signals.

A further weakness with the materials used in systematic scanning was that none of them was really peripheral or alternative as is recommended (e.g. Hiltunen 2008b) but they represented mainstream. In the background we did use blog writings but these were not used in the systemic scanning. The original idea was to include also peripheral sources for scanning, but this was given up due to lack of time. This study was more seen as an exercise into weak signals and wild cards. In future, we will definitely use more versatile sources that will also represent the underground or alternative voices.

As some of the futurists in Hiltunen's (2008b, 34) study emphasised, it is not the sources of weak signals that are important, but rather processing of them. Thus, the actual process will be discussed next. As described in methodology section, we started by discussing issues that had puzzled us. According to van der Heijden (1997, 6-8) we have tacit knowledge consisting of isolated observations and experience that we have not yet been able to integrate with our codified knowledge and this is also why we do not understand their meaning very clearly. Furthermore, he describes weak signals as this sort of unconnected insights and knowledge. It could be said that our first discussions on problems and issues was an attempt to try to understand the weak signals we had encountered earlier on. Now, afterwards trying to separate the signals from the interpretations of the emerging issues they are signalling is quite impossible.

Similarly, if one looks at the findings described in the previous section, they are not descriptions of the signals themselves but more interpretations. This is related to the debate on whether weak signals can be objective or not and whether the signal can be separated from its interpretation. It was obvious in the process, that pretty much all of the signals we found were somehow related to the problems we had discussed earlier on. One could accuse us of scanning for signals that further strengthen our previous understanding. Hiltunen (2010, 105) describes this as "collective blindness", when only signals that strengthen a vision are allowed inside an organization. She argues that this can happen easily with secondary exosignals. However, starting with a problem or issue in mind, is also part of the many methodologies described in the literature (see e.g. Linturi 2003; Petersen & Steinmüller 2009).

Interpretation, in our case, was mainly based on assessing the relevance of signals in water services sector. Hiltunen (2010, appendix 3) warns of emphasising the relevance too much as it can cause filtering especially of signals that are inconvenient but could have a big impact in future. Then again, van der Heijden (1997, 8) argues that weak signals reach our consciousness because we intuit that they have some relevance to our situation. It is a tempting idea that we could scan our environment without any preconceptions. However, in practice we do not think that this could ever work. Instead, we agree with Rossel (2009, 316) who argues that we should make “our assumptions as explicit as possible, and part of the weak signal identification process itself (i.e. taking into account the different usages we have of weak signals, according to our diverse roles and contextual interests)”. The first part of the results, describing the issues that puzzled us, is also an attempt to make our assumptions as explicit as possible.

Another issue that could probably have improved the results by helping to avoid the filtering to some extent would have been to include more people in the process with more diverse backgrounds. This way, it can be assumed, that their preconceptions, assumptions and tacit knowledge would be more diverse making the results also more diverse. The futurists in Hiltunen’s (2008b, 22) study also emphasized interaction, openness and discussion in finding weak signals.

One could criticize our approach as being too loose. Moijanen (2003, 57) for example argues that scanning for weak signals requires systematic search as one must be able to distinguish weak signals from the background noise. Then again, too mechanistic and rigid approach would probably limit the findings and kill the creativity of the process. The whole idea, after all, is to try to break some mental models and come up with events that you would not have thought about otherwise.

Our interpretations and analysis were mostly based on analogies, i.e. scanning for signals from other sectors and analyzing what these could mean in the water services sector. This kind of approach is criticized by van der Heijden (1997, 3). He argues that the validity of such analogies cannot be assessed and thus, it must be concluded that the resulting subjective probabilities are untestable, arbitrary and meaningless. However, Ruuttas-Küttim (according to Hiltunen 2010) encourages combining different contexts to weak signals in order to see their real potential.

Furthermore, it is questionable whether our findings really count as weak signals or wild cards. For example, the issue with the possible chemical contamination of tap water from the plastic pipes is more likely a gradual change than a wild card, as it is not a rapid development and water works could monitor this and change their behaviour in case some concerning results would appear. Most of the other issues we discussed are also more gradual than rapid in nature. Thus, it could be said that we were not able to recognise actual wild cards. However, it needs to be remembered that it is also important to monitor weak signals for gradual change. As Hiltunen (2006, 71) points out, people tend to ignore weak signals indicating gradual change.

Moreover, one could say that our signals are not signals but more like trends. This is due to the fact that they are presented in combination with the interpretations and they have been clustered together. Hiltunen (2010, 112) actually reminds that single weak signals do not tell us much about futures, but a number of weak signals might tell us something about emerging trends in the future. She argues, thus, that weak signals should be clustered to trends. One of the trends identified in our study could be the customers’ growing demands and willingness to make own choices. In the water services sector, it might be useful to think about how the service could be made more customer-oriented. One should also think about what the ultimate purpose of the service is. This is also related to trend of more open, political and

transparent decision-making. If politicians would assume more power and responsibility over their decisions, how would this impact water services sector? Would the resources to produce safe service be better or worse guaranteed? What if customers and citizens would be better aware of also decision-making related to water services? Would this increase or decrease resources? These are only very preliminary thoughts and it would be the next phase (not part of this study) that we should focus on developing these trends further and even create scenarios based on them.

It is debatable, whether the signals we found could be considered as weak. This again is related to our choice of material and methodology. According to Hiltunen (2010, 100-102) a key characteristic of weak signal is their low visibility, as it usually appears only in a single channel and locally. Our sources, the newspapers and magazines, however are quite widely read and their visibility is not that limited. Another criteria proposed to describe the “weakness” of signals refers to our inability to give meaning to them (van der Heijden 1997, 8). In comparison, “strong” signals would be such that we can clearly understand the potential implication. Based on this definition our finding could be characterised as weak signals. They can be considered to be strong signals in their original context, but when they are moved to the context of water services sector their implications are not clear and thus, they can be said to represent weak signals.

Hiltunen’s (2010, 6) informal test of weak signals, based on the reactions of colleagues, seems to support the claim that our findings would be weak signals. According to Hiltunen, if your colleagues oppose a signal or it is not really talked about (taboo) it can be considered weak. We presented in a course¹ to our colleagues the idea of bottled water replacing drinking water and were rather surprised by their reaction. First, there was a long silence which was followed by declarations of the stupidity of the whole idea. It seemed that they were really upset by the sheer idea of taking bottled water seriously. This confirmed our idea that it would be important to expose our sector to thinking in new ways and breaking conservative mental models to be better prepare, prevent or take advantage of events in the future.

5. Conclusions

As was discussed, it is debatable whether any of the “signals” we discovered were really weak signals by scientific definition. Similarly, we were not able to identify wild cards. Furthermore, our approach did not follow guidelines strictly. We cannot yet show that our findings would be “correct” as weak signals and wild cards can only be judged with hindsight. However, we do not think that this exercise was useless. We have already presented some of our findings to other people on water services sector. Reactions have ranged from confusion to anger. We argue that scanning for weak signals and wild cards can help one to step out of one’s comfort zone and think also about the inconvenient issues. Even if the weak signals and wild cards would not materialize in the future, it is useful to challenge oneself and think differently.

Sustainability of water services is one key issue for the well-being of people and functioning of societies. As the world changes into more complex, unpredictable and uncertain, we think this will eventually impact also the water services sector more and more. As water services sector is static and conservative, it is not

¹ The course was Management Options of Water Services and our presentation was on 14.4.2011.

very agile reacting to changes. This makes the need for long-term strategic thinking and planning even more evident. Scanning for weak signals and thinking about wild cards is an important part of this.

Based on our experience, we argue that the potential of weak signals and wild cards approach lies in the practical application, not in scientific strict methodology and rigid interpretations of weak signals and wild cards.

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9. SUSTAINABLE TRANSPORTATION

DELPHI ON TRANSPORT AND CO₂ EMISSIONS - FINNISH SCENARIOS UP TO 2050

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1. Introduction: Transport and the climate challenge

The transport sector has an interesting role in the society, as it is mainly seen as a means to an end, rather than an end in itself. Transport is important for both the economy and for social needs. In the modern societies, we move both material and people over ever-increasing distances, it seems. The costs and policies affecting transport modes tend to be measured by how much they restrict the movement of goods and people, and thereby hinder economic and social sustainability.

At the same time, the transport sector struggles to achieve environmental sustainability. It is not easy, as transport tends to cause noise, particle emissions, acidifying emissions, danger to animals, etc. In this paper, we will limit the discussion of environmental impacts to carbon dioxide. It is the most important greenhouse gas causing climate change (IPCC 2007). Efforts to limit CO₂ emissions from the transport sector in the European Union have not been as successful as reduction efforts in general (Fig.1)

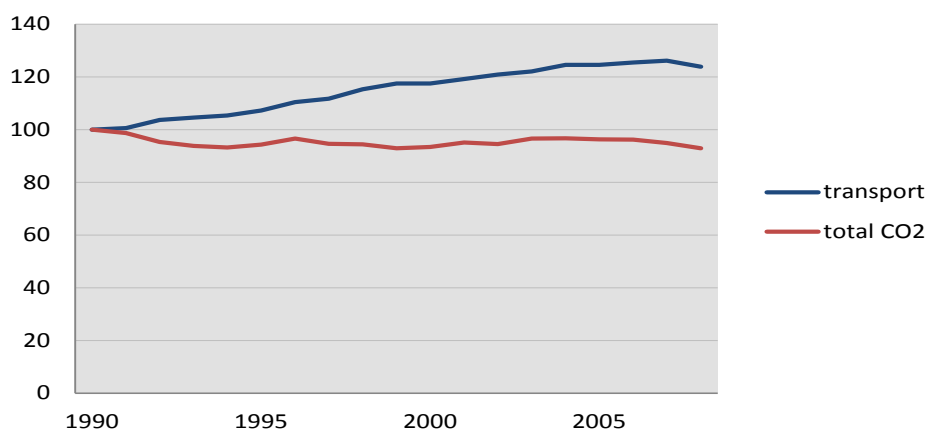


Figure 1. Total and transport CO₂ emissions from EU-27 countries 1990-2008, index year 1990=100 (EEA 2011).

The efforts to cut CO₂ emissions have increased recently in scope and intensity. For example, the European Union has introduced several important traffic-related climate policies. In 2008, the European Union agreed on a number of directives and other policies, known as the Climate and energy

package. The package set a 10 % target for the share biofuels in transport by the year 2020 (EU 2009a). In addition, emission reduction targets were allocated to sectors outside the emission trading system, such as the transport sector. For Finland, the reduction is 16 % of the 2005 levels by 2020 (EU 2009b, EU 2011).

The Finnish Government agreed in 2008 on an emission target for the transport sector specifically. The target was set as 15 % reduction of the 2005 level by 2020 (Finnish Government 2008). Also, the Finnish Government Foresight Report on Climate and Energy Policy (Finnish Government 2009) set a long-term target for greenhouse gas emissions from Finland. The aim is to cut the emissions by at least 80 % of the 1990 level by the year 2050.

These rather specific targets mean that the social and economic needs of the transport sector have to be fulfilled with much lower emissions than is currently the case. How is that to be achieved, or is it even possible to reach the targets? In this paper we will present the results of a Delphi study regarding the future of the Finnish domestic transport sector. We asked some thirty Finnish experts and stakeholders about their views of the probable and preferred future development up to 2050, covering a range of transport-related issues and using both quantitative and qualitative data. These views were condensed into seven scenarios describing the possible futures of the Finnish domestic transport sector.

2. Material of a Disaggregative Policy Delphi study

The research was carried out as a two-rounded Delphi study. We used Disaggregative Policy Delphi (Rikkonen & Tapio 2009, Tapio 2003) which does not seek to reach consensus on how the future will develop but rather will find various crystallised ways through which the future is being envisioned. The Delphi panel was chosen to represent different areas of expertise. The panel demonstrated variance in terms of age, gender, and level of education. We also wanted to have experts of different modes of transport, including both passenger and freight transport. We also looked for representatives of various societal sectors, such as government, local authorities, business sector, research, and politics. The aim was to cover the views in the field rather than to have a statistically representative sample of experts (cf. Kuusi 1999). The panellists are listed in Appendix 1. The participants were promised anonymity in terms of individual answers. The results of the first round were shown anonymously to the panel during the second round, as is usual in Delphi studies (Linstone & Turoff 1975).

The material was gathered through a questionnaire and thematic, semi-structured interviews. Some participants did not fill in the questionnaire or did it only incompletely. Consequently, we were able to analyse 32 interviews and 24 questionnaires. The first round of the Delphi included a questionnaire and interviews, the second round consisted of a new, expanded questionnaire. The first round was conducted in the summer of 2009 and the second round in the fall of 2010.

The participants were asked to give their opinion for the future they considered most probable, as well as for the future they considered preferable. The preferable future had to be possible, in the opinion of the respondent (cf. Amara 1981). Thus, each respondent provided two visions of future.

The first round questionnaire included questions for passenger transport volumes, CO₂ emissions from passenger transport, passenger car density, total car density, the average emissions of new passenger cars, the share of biofuels in transport, freight volume, freight transport CO₂ emissions, and GDP, in 2020 and 2030. The second round questionnaire included all these except the total car density

which had offered little information beyond what was received from the passenger car density. During the second round, also values for the year 2050 were asked for, as we wanted to compare the scenarios with the strategic climate documents of the Finnish government.

During the second round, new questions were introduced into the questionnaire on the basis of the analysis of the first round interviews. The development of interesting and controversial topics was asked to be estimated either on a Likert scale of seven steps or as a specific value (e.g. the price of gasoline in 2030). These questions were asked for the year 2030. On both rounds, the questionnaire was in MS Excel-format and it was sent to the participants by e-mail.

All interviews were conducted in June-September of 2009. The interviews usually lasted 1.5 to 2 hours. Taped interviews were later transcribed. The transcripts covered approximately 650 pages. The questions for these semi-structured thematic interviews were designed on the basis of the Environmental Protection Process framework (Tapio & Willamo 2008). The intention was to consider transport, its causes and effects as well as transport policy, in a holistic manner. The interviews also included some questions that were created specifically for the individual interviewee, regarding his/her specific area of expertise and/or regarding the previously filled-in questionnaire. (More information about the material and methods used in the study is available in Finnish (Tapio et al. 2011a, Varho et al. 2011).)

3. Methods for constructing scenarios

The quantitative material from the questionnaire was grouped and analysed with the help of cluster analysis (see e.g. Everitt et al. 2001, Varho & Tapio 2005). First, we grouped the variables from the questionnaire into six themes (transport volumes, emissions, economy, vehicles, policies, and other drivers). Each variable within a theme was given a weight describing its relative importance in the theme. For example, road was given a higher weight than rail in passenger transport. In addition, all variables were standardised to a scale between 0 and 100 in order to make them proportional to each other. Where a maximum value existed, such as the highest value on a Likert scale or percentage of biofuels, the maximum values on the scale were used as 100. In relative scale variables we gave the maximum response the value of 100. Minimum value was the hypothetical minimum, typically zero, or the lowest alternative on the Likert scale.

We regrouped the variables into five themes: passenger transport (economy, passenger transport volumes and emissions), freight transport (economy, freight transport volumes and emissions), equipment, policies, and other drivers. Each of these five themes was analysed separately, with a hierarchical cluster analysis, using the furthest neighbour algorithm in the PASW Statistics 18 software. This produced five sets of clusters about different themes. The number of complete numerical responses for each theme was different and also the number of clusters in each theme could be different.

This way of grouping meant that the answers of the respondents did not necessarily end in the same cluster in different themes. For example, expert A might share the view about the future of freight transport with expert B, and their answers would be in the same freight transport cluster, but their views about the future of vehicles might be so different that their answers would be in different vehicle clusters. Combined with the fact that we calculated the average value of individual answers that ended in

the same cluster (cluster mean), the clusters and the scenarios based on them do not represent the thinking of individuals but crystallized views of the future.

The qualitative material, i.e. the interview transcripts, were analysed separately. First, we grouped the arguments regarding the development of the quantifiable variables of the questionnaire. The arguments were summarised in a report (Varho & Joki 2010) sent by e-mail to the participants together with the second round questionnaire. Then, through content analysis, the views of the respondents were condensed into alternative future states of various qualitative themes.

Combining the quantitative and qualitative material, we produced a table of themes and future states, known as futures table (Tapio et al. 2011b). This table forms the basis of scenario construction. In the table, each row represents a variable, such as “passenger car density” or “car fashions”. Each variable has either quantified or qualitative alternative future states, marked in the cells of the row. Part of the table is shown as illustration (Table 1).

After condensing the material into the table, we reorganised the future states on each row in such a way that each column represented an internally coherent view about the future. This is perhaps the most exciting part of the process, as it requires a thorough knowledge of the material and theoretical understanding about the transport field but also gives room for intuition and creativity.

Table 1. Examples of the futures table variables and future states.

THEME/variable	Dev. degrowth	Urban beat	Transit-Finland	Ecomodernity	Small steps	BAU	Material growth
POLICIES -3...+3	-3,0		-0,7	-1,6	0,8	1,6	
Public transport fares	decrease sharply		decrease slightly	decrease significantly	rise slightly	rise significantly	
Pass.car density/1000 inh.							
2020	275	463	479	463	528	534	575
2030	175	395	433	395	537	533	700
2050	125	353	370	353	548	516	700
People's awareness of costs of mobility	aware of environmental costs	aware of both env. and econ. costs	aware of environmental costs	aware of both env. and econ. costs	aware of economic costs	aware of economic costs	not aware

We started the re-organisation from the largest set of variables, i.e. the passenger transport theme. The clusters represented six different views about the future. There were seven freight transport clusters, and we ended up having seven scenarios, where one of the passenger transport clusters was used twice. We continued through all the other quantitative and qualitative themes and produced seven scenarios.

4. Seven scenarios of the future

Developing degrowth

In the first scenario, the economy, as measured by GDP, starts to decline and road transport volumes decline sharply as well. Nevertheless, the “Developing degrowth” scenario is not pessimistic. The economy becomes increasingly service-intensive and the share of non-material consumption rises sharply. Determined climate policy directs the development of the society. The quality of public transportation improves sharply while at the same time the fares become much cheaper. Goods are bought from local stores. Domestic airplane use ends. There are heavy investments into bicycle networks

and sidewalks. The use and ownership of passenger cars are heavily taxed, and the number of passenger cars plummets. However, at the same time, car technologies develop rapidly, and new cars sold in 2030 are based on hybrid, electric or hydrogen technologies. The share of biofuels of transport fuels is high, partly because the overall demand is low.

Urban beat

In the “Urban beat” scenario, the economy grows steadily. Passenger transport volume does not change significantly, but the modal split changes towards soft modes and public transportation, particularly to trains. Urban intensification is significant and infrastructure for soft mode transport is improved. The number of cars decreases fairly slowly but car technology improves fast and economic driving habits spread extensively. Services and shopping can be done close to the house or in the Internet, and goods are delivered home. Public transport and infrastructure for car-pooling is developed determinedly. Domestic tourism increases, and the rise of railway transport is aided by the development of local train services around several cities. The co-ownership of trucks and combined loads become more common in the freight sector. Freight volume continues to grow, partly as a result of new mining initiatives, but the emissions are only half of the 2005 level by the year 2050. The CO₂ emissions from passenger transport decline sharply, so that in 2020 they are 35% less and in 2050 some 90% less than in 2005. Pressure from consumers and citizens drives the change in climate issues.

Transit-Finland

The “Transit-Finland” scenario gets its name from the decrease of passenger transport with the simultaneous increase of freight transport, particularly transit freight. Large volume of freight is transported in containers by rail from Asia through Russia and Finland to European markets, and back again. The domestic economy grows only slowly and settles on a steady level after 2020. The use of private car decreases sharply. The change in the modal split is encouraged by better and cheaper public transportation methods and the higher costs of car use. Urban infill proceeds significantly, but car use is also diminished by strengthening environmental values and the increase of car-pooling. On-demand public transport is used in the rural areas. The pace of life slows down and local services are used increasingly. Unnecessary hurry is eliminated, so freight transport is organised in better time with slower modes: Freight transport moves from roads to rails and waterways. Technological change is slow in terms of emission reductions. Considerable development is achieved in the field of biofuels. They are produced largely from domestic raw materials. Overall, Finland becomes a forerunner in climate policies but global expansive materialistic patterns are not changed.

Eco-modernity

In the “Eco-modernity” scenario, the fairly small growth of transport volume goes to public transportation and, in freight transport, to railways. Economic driving style becomes the norm in the freight sector. The economy grows faster than transport volumes, as the share of non-material consumption grows significantly. Faster trains reduce the demand for air travel. Car technologies

develop fast. Transport emissions decrease by some 45 % from the 2005 level by the year 2050. The EU targets for renewable energy use increase significantly, and the share of biofuels of liquid fuels is high. Public transportation is supported, and tendering increased, which help to improve and expand services. Car taxes focus on the use (rather than the ownership) of cars. Some communities start their own, more ambitious emission-reduction policies. Freight transport follows the same pattern of relatively slow growth and a modal split from road to rail.

Small steps

This scenario clings to the present and is very cautious about any change. The economy grows more slowly than before in “Small steps”. Freight transport increases only on the railroads. The image and the ease of use of public transportation improve slightly. Nevertheless, urban sprawl continues slightly and car density increases a little up to the year 2030. Motor cycle use grows in this scenario slightly faster than in other scenarios, but in general, there are only small changes in the modal split. The CO₂ emissions decrease steadily but slowly, emission targets cannot be met. Policies based on voluntary action are in use, such as energy conservation agreements between freight companies and the state. Overall, this scenario is close to *status quo*.

Business as usual

This scenario is called “Business as usual”, as certain improvements and new policies are introduced, but the vision of the future is still rather conservative. The economy grows fairly fast and the share of non-materialistic consumption increases slightly. Freight volumes increase across transport modes. Taxes on energy and environment are raised and car owners are aware of the economic costs of driving, but the urban sprawl continues and the use of passenger cars increases. The social importance given to the private car prevents policies that could significantly reduce its use. The safety and fluency of traffic flows are emphasised. Public transportation loses popularity as its fares rise and services decline. Car density remains at approximately the present level, and the CO₂ emissions per km decrease as the technology improves. New car technologies spread fairly quickly, also to the freight vehicles. While traffic volumes are on the level with the next scenario “Material growth”, emissions are lower. The share of biofuels rises more slowly than in the other scenarios, as the rising food prices, for example, slow down their production.

Material growth

The “Material growth” scenario is pessimistic in terms of emission reductions. The economy grows fairly fast. The urban sprawl continues, and two- or three-car-households become more common. Traffic volumes continue to grow, in particular the use of private cars. Automobile technology develops relatively slowly. Public transportation use develops slowly, compared to the other scenarios, as fares go up and the service declines. Airplane travel increases. The costs of driving rise due to higher taxation based on car use, and as a result of rising fuel prices. CO₂ emissions grow slowly at first and turn to a

very slow decrease after the year 2020. However, the rising cost of oil supports the increasing use of biofuels.

5. Discussion

As noted in the beginning of the paper, transport serves the needs of the economy. The traditional pulp and paper industry was widely seen to be in decline in Finland, which might reduce freight volumes. However, new mining initiatives could bring a lot of heavy loads, particularly to railways. Certainly Finland aims to high technologies, such as nano- and bioindustries, but it is uncertain where the new growth is coming from, and whether it means less material-intensive economy in the future. Some scenarios include very high freight volumes, but these could result from increasing transit, e.g., between Russia and central Europe.

In terms of passenger transport, traffic volume growth rates are reduced in many scenarios and modal splits will change mostly in favour of public transport and soft modes. Domestic aviation has a seemingly low growth potential. There is a clear difference in the experts' views in respect with freight and passenger transport. As most of the experts indicated that the service economy and other type of non-material economic growth are essential in the future, this is a rather confusing result.

The passenger transport volumes and CO₂ emissions in the scenarios are shown in Figure 2. The national emission targets are shown in the figures for 2020 (-15% from the 2005 level) and for 2050 (-80% from the 1990 level). It should be noted, however, that the emission targets have been set for the whole transport sector, not passenger transport alone, in the case of the 2020 target, and for the society as a whole in the case of the 2050 target. In addition, our figures only consider the actual CO₂, whereas the reduction targets normally apply to all greenhouse gases. Finally, we only consider domestic transport, and our calculations do not follow the IPCC guidelines exactly. Even with these reservations, it is notable that only two of the seven scenarios are able to reach the emission targets.

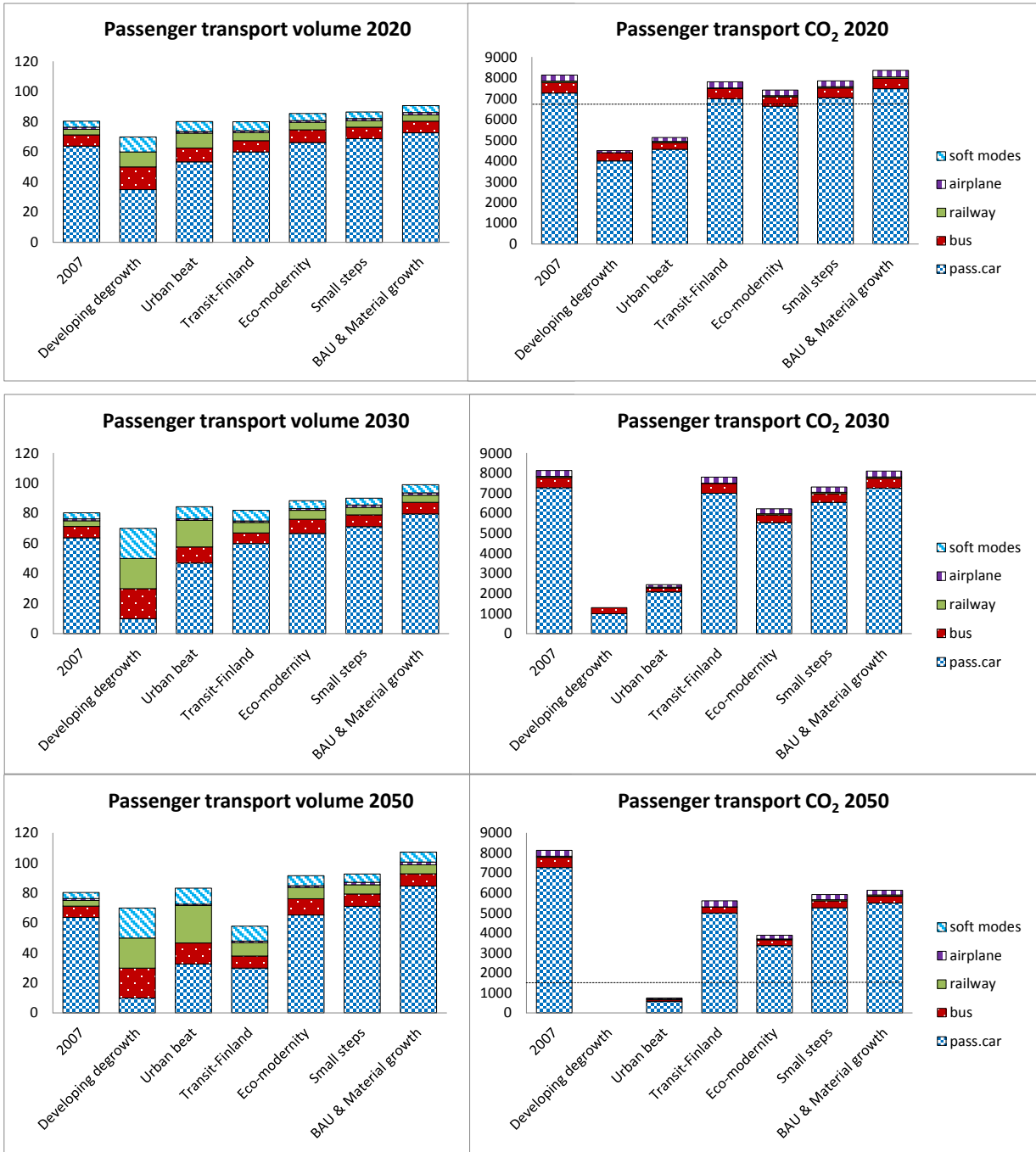


Figure 2. Passenger transport volumes and CO₂ emissions in 2007 and in seven scenarios. Dotted lines signify (approximated) national emission targets.

As these results show, many Finnish transport experts doubt that the emission targets will be achieved. However, a number of experts still consider it possible (if not necessarily probable) that transport volumes, modal split and emissions will undergo radical changes.

Significant changes can occur in various ways. Technological change is clearly one driving factor. However, Finland is a small market for cars with practically no domestic car industry, and it is clear that other countries and their policies will have a larger role in determining the innovation process. What Finland can affect directly, however, is the type of cars that are imported to and bought in Finland. The average new car emissions in Finland stayed at the high level of approx. 180 CO₂ g/km between the years 2000 and 2007. From the beginning of 2008, the car acquisition tax has been based on the carbon

emissions of the car, and the annual vehicle tax was changed in the same way in 2010. These changes seem to have had a significant impact on the type of cars Finns buy, as the average emissions have declined (Fig. 3).

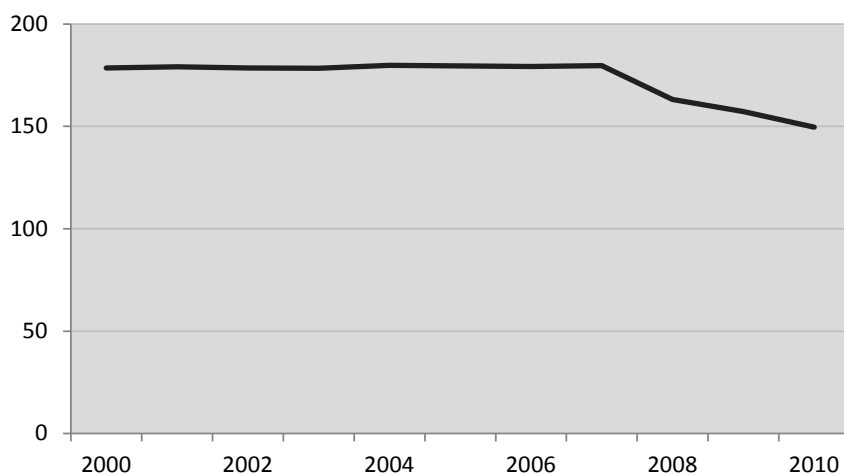


Figure 3. Average emissions of new passenger cars in Finland 2000-2010. (Source: Finnish Transport Safety Agency 2011.)

While there has been clear improvement, the current level of 150 g/km is still far from the EU targets of 120 g/km by 2012 and 95 g/km by 2020 (EU 2009c). In general, Finns have favoured fairly large cars. According to one interviewee, Finns buy cars with which they can transport five people and the week's groceries to the summer cottage once a year, even if the car is used to take one person to work the rest of the year. In all scenarios, there was an assumption that small cars would become slightly or significantly more popular and that the attitude towards owning a car in general would remain similar to date or become slightly more negative.

It is also notable that there was no vision among the experts that the transport volumes could grow fast but a technology leap could solve the emission problems. A simultaneous study on adolescents' views did find this type of thinking (Tapio et al. 2011a). Even in the long run, changes in behaviour that would reduce transport needs and change the modal split were seen to be of paramount importance.

Sometimes experts are overly pessimistic about the environmental values of ordinary people, and assume that failure to choose environmentally benign options is a direct result of lacking environmental consciousness (Salmela & Varho 2006). In this study, however, experts often emphasised the importance of routines and practical difficulties involved in changing transport behaviour. Both infrastructure and behaviour take time to change on a wider scale.

One of the key changes in the scenarios was seen to be the transfer of both passenger and freight transport from road to rail. This would require heavy investments into the railway network. Certain local railway, subway and tram initiatives would also be important.

Methods that would restrict movement in other ways than making transport more expensive were not envisioned. Certainly it is hard to see how they could be implemented in the European Union where the free movement of goods and people has always been a priority. Movement is clearly part of social sustainability as well. However, the need to move may change, as the population lives increasingly in

cities. Traditionally, Finns have often visited the countryside during warmer months, as many have summer cottages. If this trend changes in the future, it would reduce the need for private cars.

In terms of low emissions, several possible futures were envisioned. Scenario “Transit-Finland” would include longer stays on the country, perhaps more interest in small-scale farming and other traditional past-time activities. Life in the urban areas would be based more on local shops and services, with less travel into other neighbourhoods. More people would be living in the countryside, involved e.g. in the production of biofuels.

In the scenario “Urban beat”, however, life in the cities would be based more on high technologies, car-pooling and public transportation. Environmental values and services would become trendy, whereas owning a car would be a little old-fashioned. Instead of going to summer cottages, families would travel to other cities and towns on holiday by train or bus.

The scenario “Developing degrowth” shows zero emissions for transport in 2050. In addition to rapid technological change, this scenario envisions very high share of soft mode transport. It would require tight-knit neighbourhoods with good cycling networks, as well as a significant change in how people think about transport. One important factor might be health-consciousness, which would encourage people to walk and use bicycles, perhaps with partial electric engine assistance in pedalling. On the other hand, the scenario envisions rising costs of driving and economic stagnation, so people might simply not have the money to drive. That would hardly be sustainable development, however, and as the scenario is based on respondents’ preferable futures, we have to assume that the change would be based more on voluntary changes. Perhaps by 2050 environmental consciousness and infrastructures have developed so much that even quite radical changes can occur.

Acknowledgements

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Appendix: Delphi panellists

Mika Aho ¹	St1
Erno Aholammi	Finnish Vehicle Administration (now: Finnish Transport Safety Agency)
Elmeri Ahti	Suomen Liikenneliitto ry
Markku Antinoja	City of Espoo, Traffic Planning Unit
Sakari Backlund	Finnish Transport and Logistics
Nils Halla	Road Administration (now: Finnish Transport Agency)
Kati Ihamäki	Finnair
Hanna Kalenoja ¹	Tampere University of Technology

Petteri Katajisto	Ministry of the Environment
Martti Kerosuo ¹	Rail Administration (now: Finnish Transport Agency)
Kati Kiiskilä	Destia (moved to Sito)
Kari Kolsi ²	Neste Oil
Jorma Kämäräinen ¹	Maritime Administration (now: Finnish Transport Agency)
Harri Lahelma ²	Finnish Transport Agency
Kimmo Laine ¹	City Car Club
Tarja Laine	Uusimaa Regional Environment Centre (now: Centre for Economic Development, Transport and the Environment for Uusimaa)
Veikko Lautsi	Helsingin Sanomat
Petri Malinen	Ministry of Finance (moved to Federation of Finnish Enterprises)
Heikki Metsäranta	Strafica
Kaisa Mäkelä ¹	Ministry of the Environment
Kari Mäkelä	VTT Technical Research Centre of Finland
Pekka Puputti ¹	Association of Automobile Importers in Finland
Mikko Saavola	Finnish Bus and Coach Association
Vesa Stenvall	VR
Leo Stranius	Finnish Association for Nature Conservation
Tuomo Suvanto	Ministry of Transport and Communications
Ulla Tapaninen	Centre for Maritime Studies, University of Turku
Johanna Taskinen ¹	Motiva
Harri Turpeinen ¹	Neste Oil
Oras Tynkkynen ¹	Member of Parliament, climate policy specialist in PM's Office
Mikko Viinikainen	Finavia
Tytti Viinikainen	Road Administration (now: Finnish Transport Agency)
Johanna Vilkuna	Helsinki Metropolitan Area Council (now: Helsinki Region Transport)
Marja Virtanen	Alppila high school

¹ Participated in the first round only

² Participated in the second round only, not interviewed

ANALYSING THE SUSTAINABILITY OF ROAD FREIGHT TRANSPORT - COMBINING MULTIPLE SOURCES OF INFORMATION

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ABSTRACT – Sustainability in general and also in the context of transport has many dimensions. Here we concentrate on freight transport and especially on greenhouse gases (GHG). Reducing GHG and above all CO₂ emissions has become a key objective as the global attention has focused on climate change. In European projections, transport has been recognised as a sector which is growing in terms of CO₂ emissions unlike other sectors. Particularly in road freight transport there are currently no viable alternatives to fossil fuels in large extent. Also the demand for transport is expected to grow substantially.

A widely accepted framework has been constructed for analysing energy efficiency and CO₂ emissions in road freight transport. This framework links the economic activity and CO₂ emissions in order to analyse different factors and for instance to compare different countries with each other or to compare the development over time. In this paper we discuss this framework from the perspective of combining data from literature review, national statistics, web-based survey for hauliers, Delphi survey, and workshops in order to make sensible forecasts for the next decades considering the development of sustainability and specially CO₂ emissions of road freight transport.

1. Introduction

There is a growing interest to develop road freight transport into a more sustainable direction. As the carbon dioxide (CO₂) emissions are strived to be decreased in every sector of our society, also road freight transport is facing the challenge. The challenge is even greater in transport sector than in other sectors. Transport is the only sector with growing greenhouse gas emissions in Europe (Eurostat 2011). The growth has been due to growing transport activity and the growth is estimated to continue (SEC/2011/0358). Furthermore, transport is, and will continue to be, almost entirely dependent on oil (COM/2011/0144). In Chapter 2 we will discuss sustainability in the context of road freight transport.

In this paper we will look at the sustainability of road freight transport especially through the framework, which is introduced in Chapter 3. The framework incorporates different factors affecting the CO₂ emissions of road freight transport. Our main interest is to analyse the different types of methods

and information that can be connected to this framework in order to make projections and scenarios of possible futures. We will concentrate our analysis on the methods used in KULJETUS-project¹, i.e. literature review, national statistics, web-based survey for hauliers, Delphi survey and workshops in order to make sensible forecasts for the next decades considering the development of sustainability and specially CO₂ emissions of road freight transport. There are two timeframes to analyse; one is for the upcoming five years and the second the next 20 years, i.e. to year 2030. In Chapter 4 we will make a brief overview on the different methods producing multiple sources of information and data and in Chapter 5 we will present our analysis in connection to the framework. Finally, in Chapter 6, we will discuss the findings and present our conclusions.

2. Sustainability of road freight transport

The key issues of sustainable road freight transport are laid out by the UK Department of the Environment, Transport and the Regions in its sustainable distribution strategy (DETR 1999). According to the strategy, sustainable distribution should:

- (environment) contribute to GHG reduction, meet air quality and noise standards and minimise waste and impacts on biodiversity
- (economy) promote growth, secure jobs, reflect costs of transport, ensure fair competition and cheap supply of goods through efficient system
- (society) improve road safety, protect health, minimise the impact of noise, promote good access to goods and services and provide efficient distribution service to all.

Sustainable road freight transport is in a way a self-contradictory concept. This is because on the other hand it is a prerequisite for economic development and social equality, but on the other hand it inevitably causes negative environmental and social impacts. Road freight operations have several adverse impacts on people and environment. Lorries are involved in around 17 % of fatal road traffic accidents in Finland (Statistics Finland 2010). Lorries are also responsible for around 23 % of CO₂ emissions from road transport in Finland, and the share is even higher for emissions of particulate matter and nitrogen oxides (VTT 2010). The most serious adversity is, however, the continuous growth in the environmental effects of road freight transport. Despite of the European strategies, freight transport and especially road freight transport is growing in Europe, thus increasing the environmental effects.

Road freight transport is closely interlinked with the economy, i.e. the growth in freight transport is caused by growth in the economy and freight transport enables economic growth. However, the link is seen to be weakening in the developed countries (see e.g. Tapio 2005; Kveiborg & Fosgerau 2007; Sorrell et al. 2010). Partly this decoupling is due to off-shoring manufacturing from developed countries to developing countries (McKinnon 2007), which suggests that the decoupling is happening in the

¹ KULJETUS-project aims at forecasting the future of energy efficiency and CO₂ emissions in Finnish road freight transport until 2016 and 2030 in the light of current trends, as well as recommending political measures to achieve the energy efficiency and CO₂ emission targets. Project is carried out in 2011 by Tampere University of Technology in collaboration with University of Turku and Heriot-Watt University Edinburgh. Project is funded by Finnish Transport Agency, Ministry of Transport and Communications and Ministry of Employment and the Economy.

developed countries but not globally. The off-shoring would not be possible without cost efficient transport, particularly shipping as a part of global trade. Cost efficient transport is generally also environmentally efficient, but this leads to a rebound effect: increasing the efficiency of transport operations decreases the environmental impacts and costs, which enables longer transport in order to gain from e.g. lower labour costs, which in turn increases the environmental impacts of transport.

In order to prevent the rebound effect, it has been proposed that the freight transport should fully internalize the external costs it is responsible for. However, the rebound effect mainly occurs on a global scale and therefore actions against it are difficult to take. On a national scale a study in the UK by Piecyk & McKinnon (2007) revealed that lorries already more than cover their external costs to the infrastructure and the environment.

3. Framework for the analysis

The widely accepted framework for analyzing the relationships between the economy and road freight transport was introduced by McKinnon & Woodburn (1996) and further enhanced in a wide European research on the subject (REDEFINE 1999). Cooper et al. (1998) extended the framework to include the environmental effects and McKinnon (2010) introduced also monetary valuation of the environmental effects for determining the external costs of logistics operations. The basic structure of the framework has, however, remained the same. For this study, the framework, presented in Figure 1, is slightly altered by including various determinants for the key ratios, and is similar to the one presented in Liimatainen and Pöllänen (2010). Monetary valuation and other environmental effects than energy consumption and CO₂ emissions are omitted from our framework as we focus on acquiring in-depth information and projections on energy efficiency and CO₂ emissions.

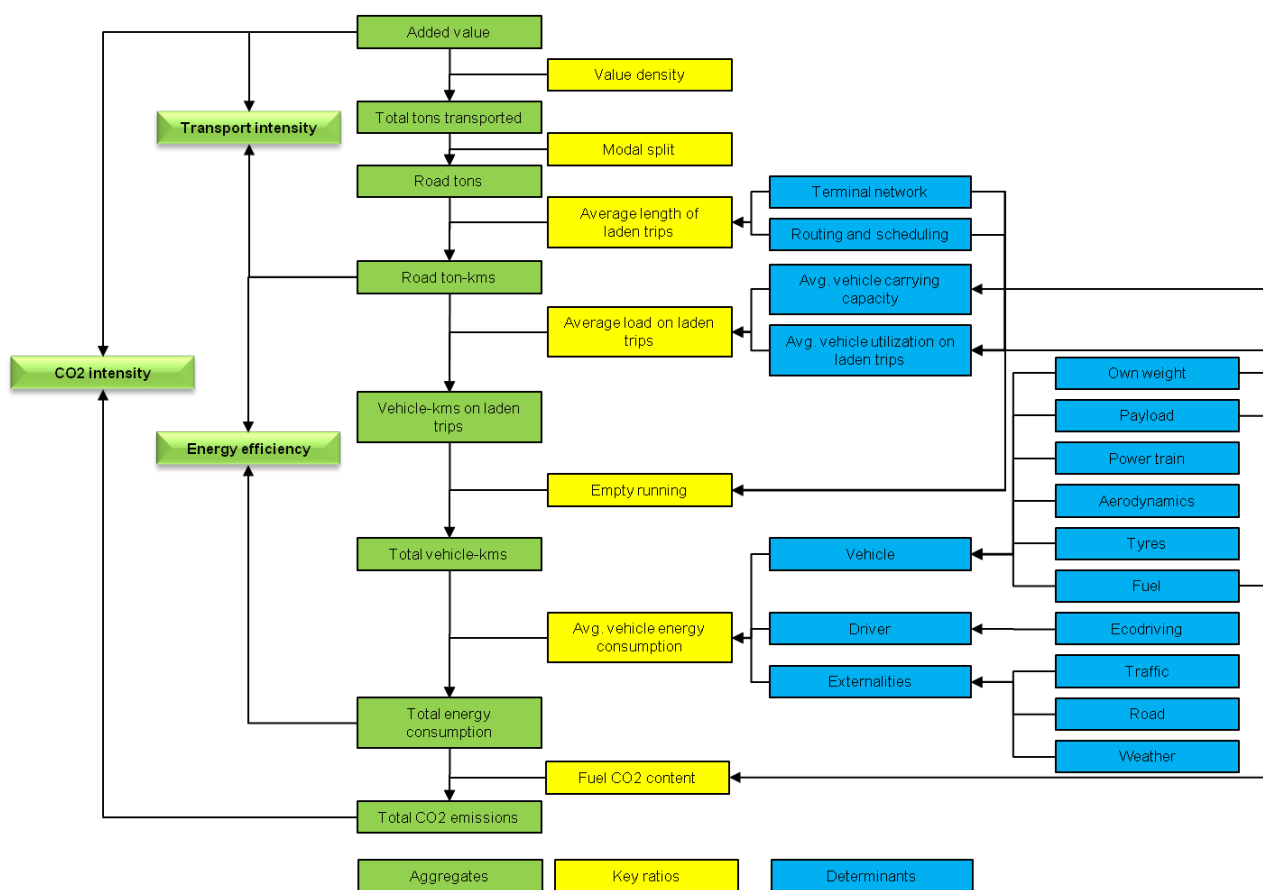


Figure 1. The framework for analyzing the CO₂ intensity of road freight operations.

The framework disaggregates the relationship between the economy and CO₂ emissions into key ratios which can be analysed to find out the causes for changes. However, by doing that some complexity may be lost and one should be cautious not to lose sight of the various feedback loops between the key ratios. While the framework includes the modal split, other modes of transport are omitted from the framework, but similar analysis can be made to other modes and changes in key ratios in other modes can affect road freight. The geographical scope of the study is also an important issue, as highlighted in the earlier discussion about off-shoring. It can be seen from the various studies cited by Lehtonen (2008) that analyses have mostly been made on national level as the data is best available for that scope. As van de Riet et al. (2008) point out there is limited and scattered data available for freight analysis because of a variety of units for measuring freight movements, confidentiality issues, various decision makers involved in a shipment and different types of loads. The solution they propose is to combine both quantitative and qualitative data from several sources.

The framework has mainly been utilised for studying the changes that have affected the road freight transport sector. It has also been used somewhat, and increasingly, for forecasting the future development of road freight transport and its environmental effects, mainly CO₂ emissions. Piecyk (2010) forecasts the CO₂ emissions of road freight transport in the UK by combining focus group discussions, Delphi survey, scenarios and spreadsheet modelling with the framework. This variety of methods was chosen since the accuracy of forecasts which rely on trend extrapolation or linking freight transport with economic development was considered low. This was because extrapolation and linkage

only are useful in stable conditions with continuous trends but road freight transport has changed over the past decades and is likely to change in the future due to e.g. globalisation and climate change mitigation. Morcheoine & Chateau (2008) also highlight this aspect as they point out that the elasticity of freight transport to GDP changes over time in relation to the maturity of commercial exchange between countries. This has to be taken into account when building long-term business-as-usual scenarios, but on short-term (10-15 years) scenarios they see elasticity having only a minor effect.

4. Different types of methods and sources of information for making future projections

As the key issue for this paper is to look at the framework introduced in Chapter 3 in context of connecting multiple sources of information for making sensible forecasts of future development, we will here shortly discuss some classifications of different types of forecasting methods. These methods can be also referred to as futures research methods or e.g. foresight methods. In our case the interest is particularly to analyse the types of information and data they produce.

Futures research methods include a variety of techniques such as trend and megatrend analyses, Delphi surveys, scenario-building, wild cards, visioning, and futures workshops. These methods can be integrated into the same study, e.g. scenarios can be based on trend and megatrend analyses. From the methods mentioned, scenarios, wilds cards, visioning and futures workshops are more often used considering long term issues. It should noted, that some methods such as scenarios or visioning may be used as comprehensive concepts, and they may already include the use of several methods. (Banister et al. 2008)

Methods are often classified either as quantitative or qualitative. However, this classification misses out the point of some methods being both, meaning e.g. that the same method can produce both quantitative and qualitative results. For example scenarios can be based on both types of data and produce results that are either or – or even both types concurrently.

Another way to look at the methods is to classify the methods based on whether they are produced emphasising expertise (e.g. expert panels and Delphi) or interaction (e.g. workshops and citizen panels), or on the other scale creativity (e.g. wild cards and science fictioning) or evidence (e.g. literature review and modelling), as Popper (2008) suggests. Also the classification of normative and explorative methods is widely used in context of futures research methods, as is done e.g. in Glenn (2009).

Aaltonen (2009) sets the futures research methods in fourfold table with the axis of “nature of possible understanding of system” and “means of controlling or directing system”. There the methods are basically classified to mathematical complexity, social complexity, engineering approaches, and systems thinking, although the methods can also be somewhere in between as depicted in Figure 2.

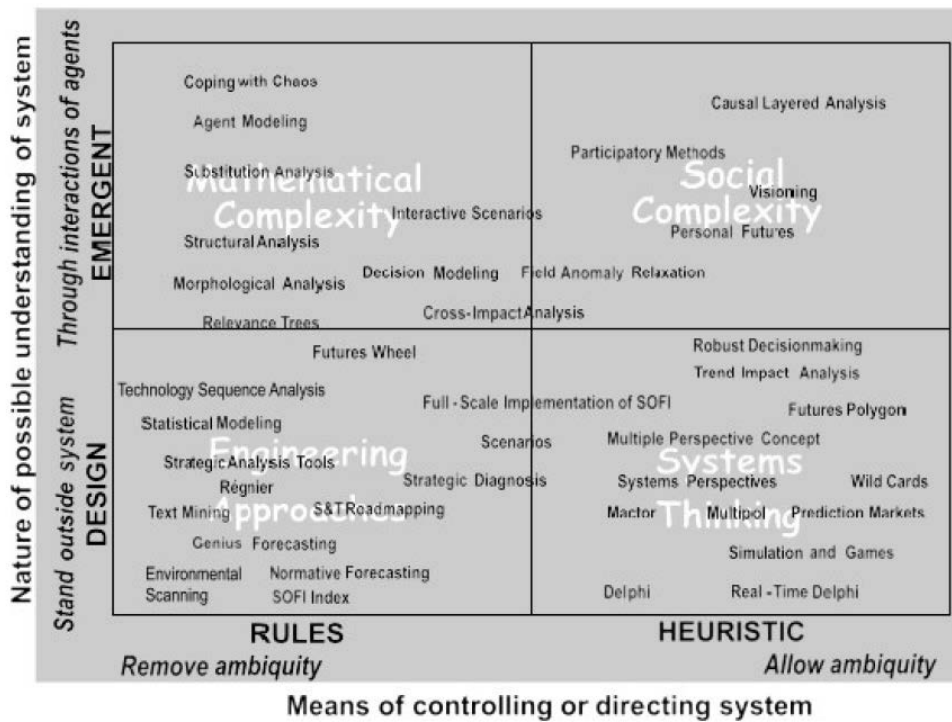


Figure 2. Evaluation and organisation of futures research methodology (Aaltonen 2009).

Aaltonen (2009) analyses the categorisation presented in Figure 2 and states that the methods in the lower left corner are relatively easy-to-use and well known, whereas the methods in upper left corner are more sophisticated and need some mathematical background as well as programming skills. The methods in the lower right corner handle ambiguity better than the engineering approaches on the left hand side, but are still limited e.g. in the number of interactions they can manage well. The methods in the upper right corner have not been widely adopted nor wholly used because of poor understanding of emergent and nonlinear phenomena. Thus these methods that handle social complexity have a big, unexploited potential.

5. Making projections of sustainability with the framework

Next we will discuss the framework introduced in Chapter 3 in context of making forecasts for two different timeframes, i.e. up to five years and up to 20 years. The reason for this is to clarify the differences of suitable methods for making sensible forecast in a shorter and longer timeframe. We will concentrate our analysis on the methods used in KULJETUS-project, i.e. literature review, national statistics, web-based survey for hauliers, Delphi survey, and workshops. Besides of analysing different methods and data sources we will discuss the perspective of combining data gathered by different methods.

The methods in the KULJETUS-project were chosen based on the examples given by Pieczyk (2010) and other studies referred to in Chapter 2 on combining qualitative and quantitative data for better understanding of the future. Our methods cover well the fourfold table in Figure 2 as we use literature-based environmental scanning and statistical modelling from the engineering approach, Delphi survey from systems thinking approach and workshops as participatory method from social complexity approach. The emphasis among the types of methods is in the engineering approach, as the statistical

analysis and literature survey form the basis for the research. In addition, the web-based survey for hauliers can be seen as a part of environmental scanning. As a combination of the results gained by these methods we form scenarios in interaction with the policy makers in special workshops to give input to the decision making that shapes the future of energy efficiency and CO₂ emissions. Another reason for the variety of methods is that there simply isn't data available to be gathered by using one single method. Even though there is relatively good statistics available for modelling, some important aspects are missing in the data.

In this context, the literature survey has the possibility to give descriptions as well as projections of different aggregates and key ratios in the framework. Currently there are especially UK based studies available, where the framework has been utilised in order to make projections considering the future (e.g. Piecyk 2010, already discussed in Chapter 3). Methods implemented in these studies have varied from statistical methods to expert methods, such as Delphi. Because of the differences between countries, the results of these studies are only limitedly exploitable in other countries. From the perspective of methods, usually the same ones can be applied, which give the researchers the possibilities to learn from each other as well as to do comparisons where applicable. For the statistical methods the limitations of the available and good-quality data may restrict making comparable studies in different countries.

The shorter timeframe, in this case five years, can be seen as projection of the past development, as the changes occurring tend to be limited – especially compared to the timeframe of 20 years. Therefore the statistical methods and modelling, especially trend extrapolation, can be seen suitable for making a base forecast for the next five years. For Finland, there is comparable statistics (Goods transport by road statistics, GTRS) available since 1995 and with the help of this data we can calculate the key ratios in the framework. Since the rule of thumb is that there should be at least two times more historical data than the extrapolated period is (May 1996), we can utilise extrapolation for the time period of five years, but not fairly for a much longer period. By making extrapolations we assume that the same forces that have influenced the aggregates and key ratios in the framework will continue to have the same effects they have had, or at least that for some reason the outcome, the trends, would be the same as before.

In Table 1 we present the data sources and the calculations used in the statistical modelling. The trend extrapolation is made based on the trends in the key ratios. This approach and the results for Finland are discussed in more detail in Liimatainen and Pöllänen (2010).

Table 1. Data sources and calculations on the aggregates and key ratios in Figure 1.

Aggregate - key ratio	Data source considering the aggregate - key ratio
Value added - value density	Annual national accounts - calculation*
Total tons transported - modal split	Transport and communications statistical yearbook for Finland - calculation**
Road tons - average length of laden trips	GTRS - calculation*
Road ton-kms - average load on laden trips	GTRS - calculation*
Vehicle kms on laden trips - empty running	GTRS - GTRS
Total vehicle kms - average vehicle energy consumption	GTRS - Combination of statistics and own calculations ***
Total energy consumption - fuel CO ₂ content	Calculation based on the aggregate and key ratio on the upper row - constant****
Total CO ₂ emissions	Calculation based on the aggregate and key ratio on the upper row

* The key ratio can be calculated by connecting the aggregate on the same and in the next row, e.g. value density is value added per total tons transported (€/t).

** In this case, the modal split is calculated only for road freight, i.e. road's share of tons transported.

*** The calculation of the average vehicle energy consumption is described in more detail in Liimatainen and Pöllänen 2010.

**** Currently the CO₂ content of the fuel, which is solely diesel in effect, when burned in the engine, is 2.66 kg/l.

When considering the analysis for the next 20 years based on the same trend extrapolation, we face the challenge of possible major changes compared to the earlier development. Therefore it is not presumable that the same regularity will hold far to the future, and thus the results are not feasible. Also the before-mentioned rule of thumb cannot be addressed with the limiting data.

It is worth to note that the available data limits the possibilities for statistical modelling and trend extrapolation. Firstly, there are interesting phenomena for which there is no data available at all. This is the case for many of determinants in the framework in Figure 1. For example, we do not have data on the development of the tyres used in the lorries and the performance of the tyres in different circumstances and real life transport assignments, even though we know that the difference between a tyre with low and high rolling resistance can account for 2 to 5 per cent (Ritola et al. 2008) difference in energy consumption for one vehicle. Secondly, the quality of data limits the possibilities for analysis. As the GTRS is based sampling, data on the detailed level cannot be analysed or in every case must be interpreted warily.

In the KULJETUS-project we use the web-based survey for hauliers to complement and adjust the information gained from the statistics. Firstly, the survey gives information on the extent of usage of various energy efficiency measures and also indications on the results from using them. It also gives information on the intentions of hauliers to start using the measures within the next five years, which enables taking these changes into account in the forecasts. The survey also adjusts the average vehicle energy consumptions that we estimated with statistics and our own calculations. For instance, it was noted that our estimates were too low for the waste haulage because our calculation could not take into account idling when loading the vehicle and the constant stopping which is typical for waste collection.

However, the survey did not give information on the long-term changes, but the hauliers were given the possibility to sign up for participating in the Delphi survey which looks further into the future. We were glad to find that almost 10 % of hauliers (28 respondents) expressed their willingness to participate in the Delphi survey.

The Delphi panel consists of the willing hauliers and also the participants of the workshops in the KULJETUS-project. This enhances the commitment of the panellists as they perceive their views shaping already the questions of the Delphi survey and also see the results and can comment them once more in the workshop after the Delphi study. In this case, the Delphi method is used particularly for generating the long term views, i.e. aiming for the year 2030. We strongly emphasise the arguments by the experts, not only the estimates they give e.g. on the development of individual aggregates and key ratios in the framework in Figure 1.

There are many complementary methods used in the KULJETUS-project and these methods produce a variety of information and data considering the sustainability of road freight transport. For the framework in Figure 1, national data used in statistical modelling is a key foundation where as the other methods can especially be seen as means to produce or to support generating views of the possible future developments. Based on these methods and the information and data they produce, we will present alternative futures which can utilise one or several inputs, i.e. we may have e.g. one forecast that is purely based on the Delphi survey and several other forecasts that are combinations of data and information produced by Delphi and other methods. Instead of just multiple forecasts, these could also be scenarios based on a futures table. The variables in the futures table could be the different key ratios in the framework in Figure 1, and these key ratios would have several alternative values based e.g. on statistical modelling or expert views. The futures table then includes many images of futures and based on the interests of the participants in the workshops, the ones for a closer analysis can be determined. As the final stage in the KULJETUS-project, we aim to connect these interesting futures to the possible actions of different decision-makers, e.g. road freight transport companies, vehicle manufacturers and politicians.

6. Discussion and conclusions

The purpose of this paper was to analyse the framework presented in Figure 1 from the perspective of combining multiple sources of information to make solid forecasts for the sustainability of road freight transport, especially the CO₂ emissions. One special interest was to study what are the differences when producing forecasts for the short-term and the long-term. For the short-term, the available Finnish data can be used in statistical modelling, and in this case based on trend extrapolation we can generate a kind of business-as-usual forecast. For a longer term, the trends that are recognised in the data will more likely be challenged by the ongoing changes. Considering the statistical modelling, it should be noticed that the quality of data limits the possibilities of this engineering approach. Thus the data analyses for the framework in Figure 1 are restricted; all the factors cannot be addressed or the data can be unreliable. Related to this, a question which is not discussed here further, is whether different approaches, not only the framework discussed in this paper, should be added or included to the analysis of the sustainability of road freight transport.

In our case, the expert methods are mainly producing views for the long-term. Some expert methods, here the web-survey for hauliers, is used mainly to support the data analysis and is useful also for the short-term analysis. Web-survey for hauliers and the literature survey done in the KULJETUS-project are seen as tools for environmental scanning, and thus presenting also the engineering approach. The goal for the Delphi survey is to ask the experts to estimate and argue the long-term development considering the aggregates and key ratios in the framework in Figure 1. As an example, we can ask the experts, what the possibilities are for changes in a key ratio, such as empty running, and by which actors, in this case e.g. transport companies together with trade and industry. The Delphi study can be stated to be a systems thinking method whereas the workshops in the KULJETUS-project are mainly a participatory method. In this case the workshops are used as a converging method where for instance different scenarios can be sketched.

As our conclusions, we state that the two timeframes, short-term and long-term projections considering the sustainability of road freight transport especially in the context of CO₂ emissions in the framework presented in Figure 1 should be addressed with different methods. This holds especially for statistical modelling, where we can assume that the trend extrapolation generates feasible results for the short-term, in this case approximately for the next 5 years, whereas for the long-term these results are not practicable. The Delphi method could also support the short-term projections, but in our case we use the method particularly to get expert views and arguments for the long-term development.

The different methods and the information and data they produce can be merged e.g. into a futures table. We emphasise creating several images of the futures or scenarios and these can exploit information and data produced by any of the methods discussed here. We assume that the interesting ones will probably be some combinations of the information and data originating from several methods. However, for the sake of decision-making we will have to produce a limited number of projections in order to have an approachable set of alternatives from which to draw implications for the stakeholders.

In the KULJETUS-project we limited our scope to explore particular methods producing different sources of information. In future, also the whole scope of futures research methods should be assessed to find whether there are methods that would produce additional or better quality information related to the framework in Figure 1. After the KULJETUS-project is completed, also the methods used here should be evaluated to define the usefulness and compatibility of the results, and based on this consider e.g. what ought to be done in a different way.

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AFFECTING THE SUSTAINABILITY INNOVATION ACCEPTANCE THROUGH SYSTEMATIC MAPPING AND RE-EMPLOYING OF ACTORS, THE CASE OF A RENEWABLE ENERGY PROJECT

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ABSTRACT – *Despite the publicly recognised need to switch to renewable energy for the sake of sustainability and the existence of a solid technical base for that, the efforts to implement such solutions often fail due to the social and business sector resistance, or an unfavourable regulatory environment. However, history shows that most innovations have to undergo transformations until they are accepted. The paper presents the method for systematically tracking and managing the factors affecting the success of renewable energy projects. The method is based on actor-network theory, which is intended for exploring the history of innovations' acceptance by mapping the controversies in the networks consisting of human and non-human actors and their relations. It is proposed in the paper that such mapping is an effective tool for assessing the current state of innovative renewable energy projects and bringing them forward to the desired outcome. It is to be reached by systematically tracking the actors in the programme, i.e. the necessary people, technologies and other factors substituting the solution, and the anti-programme, i.e. the human and non-human actors preventing the solution implementation project from success, and attempting to enrol the latter into the programme of the project or neutralise them.*

1. Introduction and Background

Sustainable development and renewable energy

The notion of sustainable development calls for meeting the needs of the present generation while ensuring that the future generations will be able to meet their needs as well (Purvis and Grainger, 2004). Shortly, this implies thoughtful and reasonable resource expenditure, responsibility for current actions while sustaining the technological progress, wealth creation and high level of life. The three dimensions or pillars of sustainability: economical, environmental and social (Adams, 2006), reflect the need for

complex and systematic understanding of sustainable development. This idea helps to stay focused on overall sustainability rather than trying to solve only environmental problems. Sustainability was also defined with the help of underlying principles (see e.g. Ny et al., 2005), which call for dematerialisation and substitution of harmful and fossil materials. Thus fossil fuels are in the focus of sustainable development along with ensuring social wellbeing and economic growth. Renewable energy, effective use of resources, recycling, and bio-based economy are among the trends that are acquiring high attention from society as the means for becoming sustainable. However, though research in the technological domain is going forward, the business side of these undertakings remains underdeveloped.

The most frequently applied environment-preserving activities employed by companies include optimisation of their internal operations: energy recovery, waste minimisation, harmful material substitution, etc. The benefits of such activities include cost saving, efficiency increase, and improved reputation. However, even if certain economic benefits arise from these activities, they constitute only a small part of what 'sustainable entrepreneurship' could bring to the companies (Cohen and Winn, 2007). Moreover, for most of companies becoming sustainable is still an issue of relationship management, rather than of the structural change in the nature and scope of their business (Adams, 2006).

In order to achieve system benefits and fundamental changes, which are required for sustainable development, the improvements need to occur on a higher level. Production of biofuel is a good example. Though the technology for 2nd generation of biofuels exists, the change towards new and more sustainable energy sources is happening very slowly. One reason for that is the need for change in many other industries and domains, not only in energy sector. The case of renewable energy project presented in this paper is devoted to a biogas production system. Production of this biofuel goes far beyond the traditional fossil fuel production value chain, if a sustainable and system perspective is considered. The challenges and barriers to acceptance also lie outside the production unit. To start with, the demand for the biofuel needs to be ensured. If there is no constant and substantive demand for the fuel, then its production appears to be unfeasible. In the case study presented in this paper it was planned to utilise biogas as a traffic fuel. This in turn poses a number of other challenges, i.e. the need for distribution infrastructure, availability of gas-fuelled vehicles and their servicing, the will of community to purchase the fuel, etc. On the other side of the value chain, there is biomass that is required for biogas production, which needs to be produced or purchased in the necessary volumes. This fact connects the biofuel industry to farming, waste management, food industry and all other sectors that can provide biomass for biogas production. The technology of biofuel production sets certain limits on the raw materials that might be used, the volume of the input material and the utilisation of by-products e.g. for fertilisation. Altogether the companies, technological, legal and other elements constitute a complex system for sustainable biofuel production, distribution and utilisation system. Though many people may see the idea of such system as sustainable and 'green', the companies inside it have different priorities and interests, and other influences and barriers exist, slowing down the implementation process.

Therefore it is crucial to identify all the critical actors in the system, i.e. companies, people, legislation, technology, and the ways to attract them into the system. This kind of systemic view is necessary to analyse the systems like the biogas production system in all their interconnections without compromising the complexity of economic, social, environmental, technological and other dimensions. Actor-network theory (ANT) approach (Callon, 1986; Latour, 2005) appears to be suitable for identifying the critical actors, or elements, of the system, as it allows to map heterogeneous actors in the system –

both human and non-human (companies, authorities, technologies, laws of physics, etc.) and identify which elements support the system design, which ones oppose it and how to deal with arising controversies.

Actor-network theory

Actor-network theory became known from the writings of Callon (1986: 196-223) and Latour (1987, 2005) on sociotechnical systems and their formation. The distinct feature of ANT is the attempt to dissolve the dualism between actors and structure, micro and macro level, global and local (van der Duim, 2005). This is achieved by treating all the elements equally, be they human or non-human. ANT has been used e.g. for researching the change processes in sustainable consumption (Heiskanen and Rask, 2008), mapping controversies in projects (Markowski and Csösz, 2008; Sage et al., 2011), exploring the phenomenon of tourism as a network-actor entity (van der Duim, 2005).

Socio-technical diagrams (see Figure 1) are a means to identify, which actors are supporting or opposing the system, i.e. are enrolled in the programme or antiprogramme of an innovation. This mapping brings a researcher closer to the understanding of how the opposing actors can be co-opted, and how the supporting actors can be strengthened.

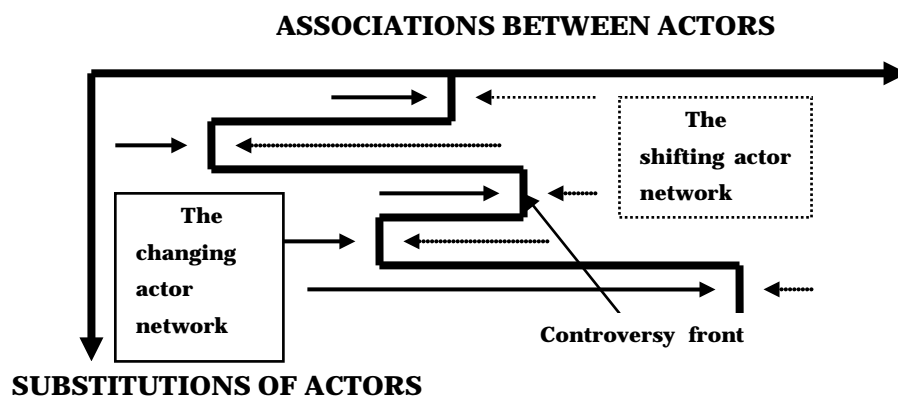


Figure 1. Principle of a Sociotechnical diagram (Markowski, 2008)

ANT was developed from the research of diffusion of innovations. Also it is designed for tracking and unravelling unresolved situations (Markowski, 2008). Therefore ANT appears to be an appropriate theory for analysing the development of a biogas production system in focus. Obviously, it is a difficult task to force the switch from the traditional view of fossil-based industry towards the renewable energy without considering all the possible influences coming from both human and non-human actors in their complex interrelations and combinations. The approach and ANT-derived tools are able to support a detailed mapping of actors and controversies around scientific innovations and further 're-assembling' the interconnections in order to help the idea of sustainable production systems and 'green' energy to get accepted and diffused.

The structure and aims of the paper

The paper continues with the description of the material used for conducting the research and methods for collecting and analysing it. Then the method for mapping and re-employing actors in the system is presented in the 'Results' section. The benefits and limitation of applying the method are discussed in the following section together with drawing the main conclusions.

2. Material and Methods

The research comprised a case study of a renewable energy project, carried out in January-May 2011. The collaborative research approach allowed high involvement of the researchers into the design and development phase of a biogas production system. The ANT-derived method was developed and used during the project for mapping the actors and revealing their associations. The design of the biogas production and utilisation system was carried out in three iterations, which included mapping of actors, application of the ANT-derived method for revealing the programme, antiprogramme, and the ways to strengthen the supporting associations of actors and re-employ or neutralise the opposing.

The data on the critical actors was gathered through interviewing people from various parts of the system: biogas production, vehicle operators, farming, citizens, businessmen, etc. The aspects that were brought up in the interviews as the most important were mapped as the actors.

The Dependency Structure Matrix (DSM) has been used for mapping the actors in a systematic way, and for revealing their interconnections and constellations. The DSM is a known tool for mapping complex systems and interdependencies (Hellström, 2005), which is why it was chosen for the purpose of the research.

Case description

The focal biogas production and utilisation system is based on the integration of traffic, waste management, biogas production industries, and agriculture. The cooperation within these industries is required for ensuring the availability of biomass for biofuel production and the adequate demand for the produced fuel. The city authorities play the integrative and coordination role, as the bio-economic solution is designed for a municipality (see Figure 2).

The value chains of sustainable food production in agriculture, biogas production and distribution, gas vehicle distribution and waste management are in such connection that they form an example of an industrial ecosystem (Cote and Hall, 1995; Ehrenfeld and Getler, 1997; Eilering and Vermeulen, 2004; Korhonen and Niutanen, 2004), in which one industry benefits from another and is sustainable as long as other industries are.



Figure 2. The biogas production and utilisation system

To enable such a system commitment from various companies, governmental units and individuals is required. At the same time there are technological limitations and requirements to the process of biofuel production, distribution and consumption. The political, pricing, communicating mechanisms are required to design a really integrated system of this type. However these mechanisms are not obvious and may be location-dependent. Therefore the method based on ANT was used to identify what are the elements or actors in the system, how they are connected and thus can be influenced.

3. Results

The research of the case system showed that the coordination and integration problems were highly relevant for the industrial ecosystem in focus. Certain functions, responsibilities and roles were unassigned. The mapping of actors with the help of ANT allowed better understanding of which elements were missing, contradictory or obstructing for further system development. The stages of applying the ANT-derived method are illustrated in Table 1. The important feature of the method is that it is iterative: after the 6th step the process is repeated, since new actors in the antiprogramme may arise, and the associations change.

Table 1. Steps of the ANT-derived method

Step	Name of the step	Description
1	Actor mapping	The step implies listing crucial actors in the system or project.
2	Programme-antiprogramme mapping	The mapped actors might support (Programme) or oppose (Antiprogramme) the system. Also, there might be actors that are currently neutral or their attachment is not yet defined (Neutral), which can affect the system significantly when their attachment becomes clear. At this step it is important to define to which group actors belong.
3	Degree of support or nuisance	At this step the degree to which the actors may affect, either positively or negatively, the system is defined.
4	Associations mapping	The associations or constellations of actors are defined through mapping interconnections between them.
5	Analysis of actors and their associations	The data generated during the previous steps allows to identify what actors are of crucial importance and need to be paid attentions to, as well as how they are connected to other actors, thus how they can be influenced or influence the system.
6	Enrolling and neutralising actors	The analysis in the previous step gives the input for this step, where the means to neutralise antiprogramme and to transfer the neutral actors into the programme are identified.

To illustrate how the method was utilised for the biogas case analysis, the step-by-step description is provided further. The first stage was to map all the critical actors – the ones that define the constellations in the system, that enforce or obstruct its implementation and functioning. The initial list of actors was obtained through interviewing the people related or potentially related to the system and reflecting on what are the critical elements or challenges. Here, as ANT implies, the actors are heterogeneous and are not classified into any groups by their character. Thus the actors included human and non-human actors.

Mapping was continued with identifying if an actor belonged to the programme or antiprogramme for the biogas system and what was the degree of the value it may add or potential nuisance. For mapping that, the DSM was created that contained all the defined critical actors. Then the effect on other actors in the system was identified. The effect could be of three types: supporting (Programme – P), obstructing (Antiprogramme – AP), or neutral (N). The figure from 1 to 3 indicated how strong influence the actor has on the corresponding actor (the bigger number – the more influence). By identifying the influence and degree of influence of an actor on other actors it was possible to sum up the ‘influence points’ and identify how strongly an actor was able to affect the system in total.

The DSM allowed visualising the interdependencies between the actors as well. The result of the first iteration of mapping (Steps 1-4) is presented in Table 2.

After the 4th step the analysis of the data was performed. It may be seen from Table 2 that though the antiprogramme is much weaker than the programme for the system, there is a significant number of actors that are neutral. In this case, most of the actors were neutral since their impact was not yet defined. For instance, one of the most critical neutral actors – number 10 – was the actor “Biogas price”.

The DSM shows that the price for biogas is influenced by many actors, such as production volume, transportation distance, etc. At the same time the price for biogas itself influences a significant number of actors, but is neutral currently. In this case neutrality means that it is difficult to identify if the price will affect the system and actors positively or negatively. If the price for biogas is too high, it will influence all the connected actors negatively: the demand for biogas by big customers will go not grow, the acceptance of the system will be low and the commitment of the city and business world will be difficult to establish. On the contrary, low price for biogas is able to attract more customers and increase the commitment of various actors.

Table 2. DSM for mapping actors and their interdependencies

Actor	Degree of commitment			Actor																									
	P	AP	N	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	
1			5	3								2																	
2	21			3	3		3	1	1			3	1	3								1			2	2	1		
3		2	8	2		2	3					2							1										
4	20			1	2	2		1	1			2	1					1	2		1			2	2	2			
5	11								2			1	1					1	2					1	1	2			
6	15	1	2		2				3			3									2	1	1	2	1	2	1	2	1
7	5		2		1			3				2																	1
8	4	7		3	1		2					2		1					2										
9	6			3		2													1										
10			15			3	3					3		2					2						1	1			
11	13			1	3		1	1	1			2									2			2					
12	2		4	1					2			1										2							
13			7	2					3			2																	
14			4	1					2			1																	
15	5			1		1	1												2										
16	4					1	1											2											
17		4				2	2																						
18			16		2							2										2	3	2	2	3			
19	2	1										1																	2
20	6												2												2	2			
21	4											1	1												1	1			
22	1														1														
23															1														
24			9			2	3					2									2								
25	3		4									3		2	2														
26			7			3	3					1																	

After the first iteration the important actors in the antiprogramme were identified: for example, “Biogas-driven vehicles price”, and “High investments into the infrastructure for the system”. The most important actors that were neutral included number 10 “Biogas price” and number 18 “Transportation distance for biogas”. During the 6th step the critical actors were addressed and solutions for enrolling and re-employing the actors were found. To illustrate the analytical process, we focus only on the most crucial actors in this paper. However it is important to underline, that all the actors were addressed in the real research process: the possibilities of re-employing actors from antiprogramme, enrolling neutral actors and strengthening the impact of actors in the programme were analysed.

During the 6th step the following solutions were proposed and new actors introduced:

1. The actor “Fertiliser sales” was introduced to increase the biogas plant profitability and therefore decrease the biogas price. The actor also influences the sustainability of the system in ecological terms because of the use of local organic fertiliser in the area.
2. The actor “Commitment of big consumers to purchase biogas” was crucial because it affected the cost of biogas production and hence the price for biogas: the more biogas is produced, the lower production costs are. For increasing the commitment the actor “Natural gas backup” was introduced. It allowed increasing trust of big consumer in the biogas system in general. This illustrates how understanding of the interdependencies between the actors allowed manipulating them in order to strengthen the programme.
3. The distribution challenge, connected to the antiprogramme actor “Transportation distance for biogas” lied in the fact that this distance affects the transportation costs for biogas, and thus its price and sustainability of the whole system. The solution proposed was to build a pipe for biogas transportation and heavy vehicles depots with filling opportunity. Such solution is more sustainable and feasible, because it does not involve transportation by vehicles (potentially operating on diesel) and decreases distribution costs. By introducing the actor “Biogas transportation by pipe” and the actor “Bus and heavy vehicle depots with filling opportunities” the 18th actor “Transportation distance for biogas” is no more a neutral actor with high impact, but rather is enrolled into the programme, since the transportation through pipe has proved to be the best option for the system.
4. As a result of introducing the actor “Biogas transportation by pipe”, the actor “High investments into the infrastructure for the system” mentioned earlier does not have as significant impact on the system as anticipated, and therefore does not affect the price of the biogas significantly.

After the new actors are added to the DSM and the interdependencies are re-mapped, a new programme-antiprogramme setting is created. During the second iteration of the analysis steps 1-6 of the process described in Table 1 are repeated by updating the DSM with the newly introduced actors and their effects on other actors. Then, the critical actors are addressed further. After identifying the new or previously existing actors that are significant in the antiprogramme or neutral position, the steps 5 and 6 were carried out again. This allowed developing solutions to other challenges:

1. The actor “Differentiated pricing for biogas” was introduced, which allowed setting lower price for customers purchasing big volumes of biogas and higher price for customers with lower demand. This means that the big consumers become even more committed to use biogas, while the price for individual users remained competitive compared to currently used fuels, or even slightly lower. As a result, the increased commitment of big consumers ensured bigger volumes

of biogas produced, giving economy of scale and further decrease in production costs. By introducing this actor the most crucial actor “Biogas price” becomes fully enrolled into the programme and supports it.

2. Since the price for biogas can remain on the same level for years, it becomes more attractive for the customers compared to fossil fuels with their constantly fluctuating price. Moreover there is an actor “Fixed-price contracts for biogas” introduced to offer such contracts to the customers, which increases their commitment to utilise biogas even more.
3. The actor “Biogas-driven vehicles price”, which belonged to the antiprogramme, is neutralised, since the competitive price for biogas allows compensating the initial investments into the vehicles.

Figure 3 illustrates how the programme-antiprogramme constellation changed over iterations of analysis and design of the system. The controversy front line is shifting from iteration to iteration (as in Figure 1), and the size of the circles shows the effect of the actors on the system. It can be seen that by third iteration the antiprogramme is eliminated by neutralising or re-employing the actors into the program. The neutral actors also have less weight, which means in case they become enrolled into the antiprogramme, their effect will not be dramatic. At this stage it is not possible to claim that all the challenges were already addressed. For example, the challenge of biomass supply for biogas production may arise in the future when the demand for the fuel increases. It is planned to map and solve the problem by further applying the ANT-derived method proposed in this paper.

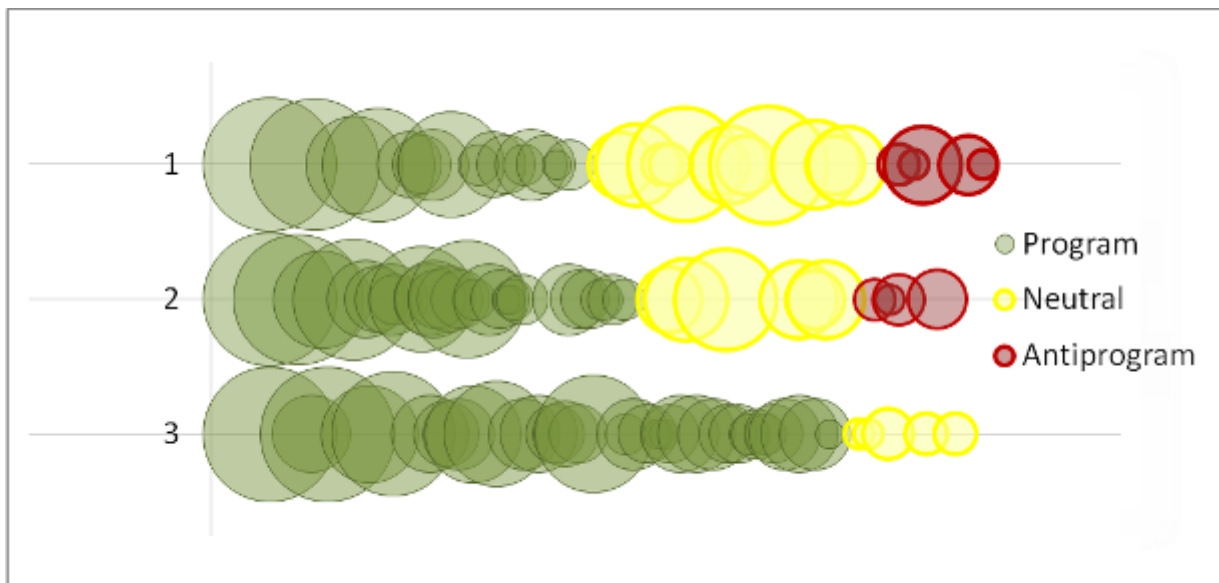


Figure 3. Degree of impact of actors in the programme, antiprogramme and neutral position throughout 3 iterations of system development

4. Discussion and Conclusions

The method proposed in this paper can be used for designing sustainable industrial ecosystems, such as the focal biogas production and transportation system. The benefit of the method lies in the fact that it addresses the sustainability of the system from a practical perspective: what are the prerequisites for such a system to be economically, environmentally, and socially sustainable while being able to “survive”

in the real world? Since the lack of commitment and cooperation proved to be the main factors undermining the diffusion of sustainable production systems, it was crucial to address the viability of such systems. The iterative process of mapping and analysing, which actors support, obstruct and interfere with each other, allows implementing the detailed design process that actually deals the complexity of innovation acceptance. Thus the designed system is not an idealised vision of a sustainable production and transportation system, but rather a thought-through system that can be implemented and potentially has more probability to sustain.

The balancing of the system was done through alternating between technical, political and business mechanisms. These mechanisms can be projected on the three dimensions of sustainability, as envisioned in Figure 4. The three new sub-dimensions need to be taken into account when designing industrial ecosystems, since they are able to affect the traditional ecological, economical and social dimensions of sustainability. As an example, the price of biogas, which was a critical actor in the focal system, could be affected by developing more efficient technology, by providing subsidies for the biogas producer, or by developing a more effective pricing model. The three options are mechanisms from technological, political, and business dimensions accordingly. Though the latter option was chosen in the research, other two options were discussed and may still be introduced if they are to affect positively the whole system.

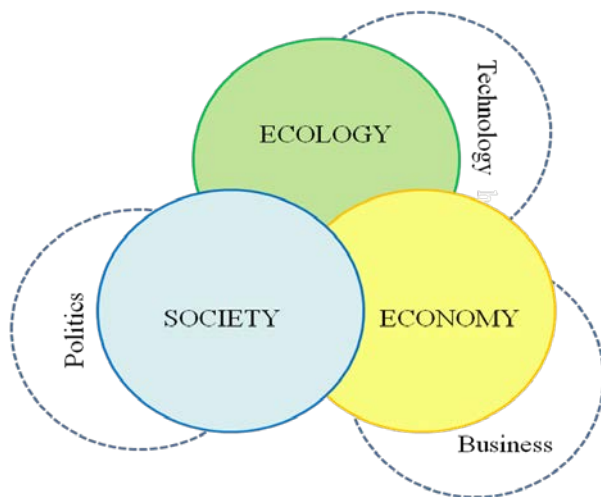


Figure 4. Extended dimensions of sustainability (adapted and modified from Adams, 2006)

The distinguishing feature of the method proposed in this paper is the possibility for fluctuating system boundaries. The boundaries of the focal system changed from iteration to iteration as new actors were included. This happened partly due to the introduction of new actors and their effect on the system. Partly, the boundaries moved when the system naturally evolved. For example, if the demand for biogas increases, there arises a need to find other sources of biomass, which will inevitably introduce new actors and change the programme-antiprogramme constellation. The question of boundary setting has been crucial in industrial ecology, especially concerning industrial ecosystems. Such systems are very dynamic and complex, and it is difficult to set strict boundaries for them. However, it depends on the analysis purposes whether the system boundaries need to be defined. E.g. energy balance calculations or material flow analysis urge for boundary definition, whereas the ANT-derived method implies that there is actually no need for them to be pre-set and fixed.

Recapping the above discussion, the method proposed in this paper is particularly useful for analysing and developing complex systems, the boundaries of which are difficult to establish and the impact factors of which are very heterogeneous in their nature and degree of impact. The method allows focusing on the crucial actors, mapping the interdependencies between them and utilising this information for changing the systems towards better stability and feasibility.

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SMALL STEP TOWARDS SUSTAINABLE TRANSPORT? MEDIA DEBATE OVER FINNISH CAR TAX REFORM

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ABSTRACT - Environmental and societal impacts of transport policies are key determinants of sustainable future. Finnish car tax reform was enacted in 2008. The national level reform was based on EU level requirements for carbon dioxide emission reductions, ultimately aiming to promote more sustainable transport. Based on material from the dominant Finnish newspaper, *Helsingin Sanomat*, we analyze the public discussion on the topic. By using the Environmental Protection Process (EPP) framework as a conceptual tool, we perform a quantitative content analysis on the media discussion of car tax reform. The EPP framework is an integrative tool aimed at gaining an overall view of the characteristics of environmental problems and mitigation measures. Our study suggests that societal factors, emissions, targets, measures and potential side-effects of the reform dominate the media discussion of the car tax reform. The future orientation of the discussion appears to emphasize short-term impacts over longer time perspectives. Overall, it seems that despite of relatively wide-ranging discussion, the media debate contributed only marginally to the public understanding of the prerequisites of sustainable transport.

1. Introduction and Background

Anthropogenic climate change has emerged as the most pressing popular environmental concern of the early 2000s. This is largely due to the heightened media coverage, especially after 2006 (Boyce and Lewis, 2009; Boykoff, 2009). Various mitigation and adaptation strategies for climate change have been demanded and sought for through almost all sectors of society, and media coverage is a key factor also in these processes of mainstreaming the climate policies (Lyytimäki, 2011).

Transport is one of those sectors where effective measures have especially been called for (Kahn Ribeiro et al., 2007; Givoni and Banister, 2010). In the European Union (EU-15 Member States), emissions of greenhouse gases from transport (excluding international air and maritime transport) increased by 20% during 1990–2008 and the transport sector was responsible for 21% of the total greenhouse gas emissions in 2008 (EEA, 2011).

The European Union (EU) has aspired to be the leader of international climate policy. In January 2008, the EU presented a climate and energy package that was intended to be the showcase of European

environmental leadership (Uusi-Rauva, 2010). Already before the recent upsurge of public climate debate, the European Commission urged the Member States to develop taxation based on carbon dioxide emissions instead of high car acquisition taxes (CEC, 2005). The EU also has an explicit target of reducing average new car emissions to the level of 140 grams of CO₂ per km by 2008, and to 120g/km by 2012.

The proposal for a common European directive for transport taxation has not been accepted, but by March 2011 already nineteen EU countries out of 27 have followed the idea in some form or another (ACEA 2011). In Finland, the car taxation was reformed in the beginning of 2008 (Finnish Government, 2007). The national level reform was based on EU level requirements for carbon dioxide emission reductions. In the reform, the car tax levied on passenger car upon registration and the annual vehicle tax were staggered in proportion to the carbon dioxide emissions (g/km) of the vehicle regardless of the power source. On average, the car tax level was cut by about one sixth.

The aim of this study is to analyze media discussion of the Finnish car tax reform, with a special emphasis on environmental aspects of the reform. We explore how the environmental problems of transport are discussed and what kind of an environmental policy measure the car tax reform is regarded in the discussion.

2. Material and Methods

The study builds from the agenda-setting model suggesting that the media may be influential on defining what the social priorities are but they have less influence on defining what to do about them (Cohen, 1963; McCombs and Shaw, 1972; Pralle 2009). The agenda setting model does not assume a direct and linear correlation between the coverage of specific environmental problem, public opinion and a policy action. Instead, it maintains that by giving prominence to certain issues and framings the agendas of the mass media influences public and policy agendas. The key media setting the public and policy agenda in Finland is chosen to be the research material of this study.

The material was collected from the Finnish broadsheet newspaper Helsingin Sanomat (HS). The HS is the most widely read newspaper in Finland, with almost one million readers and a daily circulation of almost 400 000 copies (FABC, 2010). Because of the dominant position of the HS in the Finnish media markets (Herkman, 2010) it is reasonable to assume that this material gives a relevant sample of the Finnish debate.

The articles were collected from HS's online archive (<http://www.hs.fi/arkisto>). This electronic archive contains news material published by the newspaper from 1990 onwards. It includes the titles and texts of the printed material. The aim was to find all the articles that covered car tax reform and environmental issues. Based on testing of several search options, the following search string (with Finnish words) was employed: "(car tax* OR vehicle tax*) AND (environment* OR climate* OR emission* OR carbon dioxide*)". The search was performed to a period of 1.1.2006-30.4.2010. The search produced 262 articles, from which irrelevant articles were deleted. Articles were considered as irrelevant, if they didn't relate to this particular car tax reform or if they only mentioned car tax reform briefly and neutrally, without any comment on its effects. After this screening the material resulted 131 newspaper articles that were included as the material of this study.

Quantitative content analysis was performed to the material (Krippendorff, 2004). A coding scheme consisting of 67 independent variables was developed. The variables included information describing the news item such as title, date, length, and newspaper section. Other variables described attitudes towards different environmental policy measures and car tax reform in the articles. In addition, actors, future orientation and viewpoints were examined. Furthermore, a set of variables were determined based on the modified version of the Environmental Protection Process (EPP) framework (Willamo, 2005; Tapio and Willamo, 2008).

The EPP-framework is an integrative tool aimed to holistically grasp the overall process through which environmental problems are created and settled from systems thinking perspective. The framework is based on distinction between interacting ecological and human dimensions with different elements (see also Figure 3):

- **Driving forces.** Individual factors affecting human action include e.g. knowledge, values, emotions, experiences and resources. Societal factors affecting human action include e.g. politics, administration, legislation, science, religion, economy, mass media, education and social activism. Ecological factors affect human action both directly and indirectly. The effect of individual, societal and ecological factors on human action is filtered through the physical infrastructure, such as road network.
- **Action.** Environmental problems are due to variety of human actions and actors. Actions can be interpreted as a simple act, such as driving a car or a whole societal sector, e.g. transport.
- **Intakes/outputs.** Human action causes intakes from and outputs to the ecological environment. The intakes and outputs can be divided to energy, substance, living material or macro structures. For example, removing trees before construction of a road is an intake of living material that affects also on energy balance, material flows and landscape level structures. Examples of outputs include planting of plants, releasing asphalt on road-top or emitting greenhouse gases in the air.
- **Ecological changes.** Intakes and outputs cause primary changes in the ecological environment, such as change on noise levels near traffic area or carbon dioxide concentration in the air. The primary changes can cause secondary (and tertiary) impacts such as changes in species composition or abundance or climate change.
- **Human impacts and environmental problems.** Ecological changes cause human impacts. Some of the changes or impacts can be interpreted as harmful environmental problems while others may be valued as positive. Changes below certain critical thresholds may remain unnoticed or they may be considered as insignificant. Climate change discussion is a typical example of a debate with highly varying interpretations of the severity of problem.
- **Targets and measures.** If a particular change or impact is perceived as a problem, a target can be outlined for satisfactory state of the environment. When a target is set, measures are needed to reach the target. For example, decreasing the carbon dioxide emissions from traffic is a widely – although not universally – agreed target, but there may be widely differing views on appropriate level of emissions, emission reduction timetables or means to achieve the target. The car tax reform is such a means.

Since the coding of the material was open to subjective judgement, the intercoder reliability was tested with Cronbach's Alpha. The testing gave a coefficient of .798 which can be considered as acceptable.

3. Results

The debate over car tax reform in Finland began after EU had published a directive proposal on car taxes (CEC, 2005). The EU proposed that member states would bind the car taxes to carbon emissions of a vehicle and that taxation would be altered to emphasize the car use instead of owning. The public discussion in Finland started little by little and was not lively until politicians confirmed the preparation of a legislative proposal in the beginning of 2007 (Figure 1). During the preparation phase, spring 2007, the discussion was vivid and included a considerable array of viewpoints to the carbon dioxide emission based car taxation. The discussion dwindled when the Ministry of Finance announced in the mid-2007 that the annual vehicle tax would be staggered in proportion to the carbon dioxide emissions in 2010 and alterations to the car registration tax were not planned. The changes to the annual vehicle tax were generally welcomed by the media.

A legislative proposal to alter the car registration tax was unexpectedly published in March 2007. Before this some criticism was presented on concealment and secrecy of the planning of car tax reform, since no official comments were published due to fears of car sales market instability. The discussion and news material on topic was plentiful after the publication of the planned reform. After the legislation came into force in the beginning of 2008, the discussion gradually faded away.

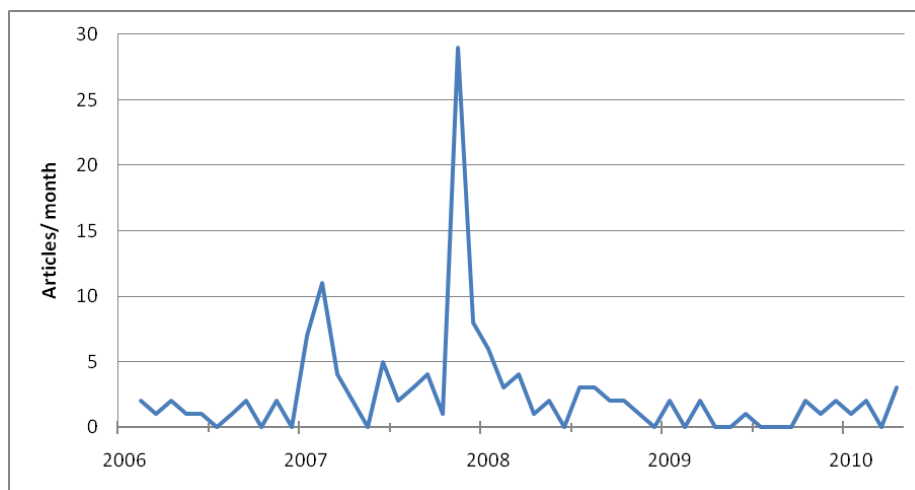


Figure 1. Number of newspaper articles per month. (N=131)

Majority of the discussion (86%) was published as letters to the editor, domestic news, editorials and in car-section (Figure 2). The attitudes towards car tax reform varied greatly between different sections. In letters to the editor, attitudes towards the reform were mostly critical or negative. In contrast, in editorials, which reflect newspaper's policy on different subjects, the attitudes towards reform were remarkably positive. Also in the car-section and in domestic news the attitudes were rather positive. In

general, attitudes towards car tax reform as an environmental policy measure were positive. Also critical views were expressed, but generally car tax reform was considered as an effective measure to solve environmental problems caused by transport.

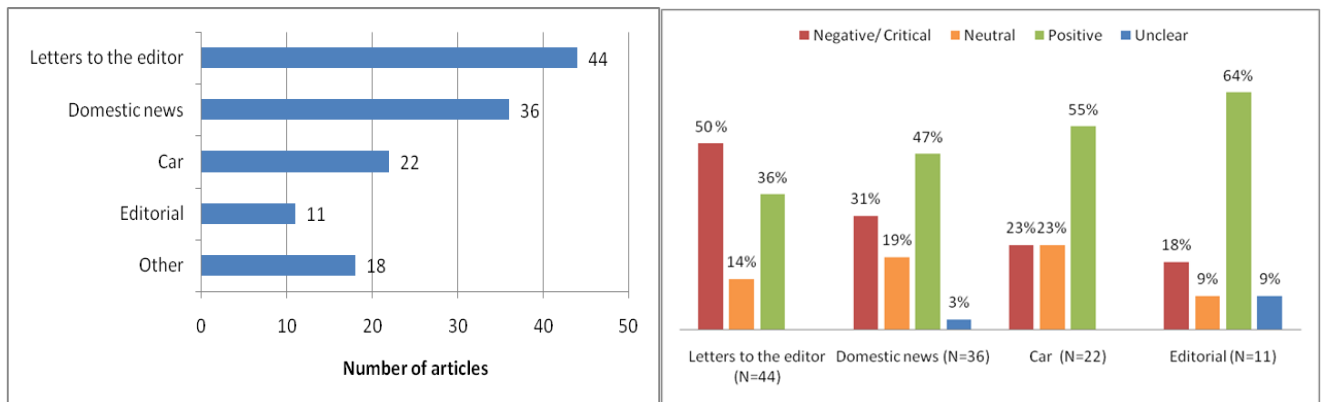


Figure 2. Number of articles per newspaper section (left panel) and attitudes towards car tax reform as an environmental policy measure in different newspaper sections (right panel).

The EPP-framework distinguishes between human environment and ecological environment as two functionally different but interacting major systems (Figure 3). In this study, the results indicate that societal factors, actions, emissions (i.e. outputs), targets, measures and potential side-effects dominated the discussion of the car tax reform. Thus, the discussion circulated largely around human environment, while issues of ecological environment (e.g. climate change) were only rarely mentioned.

Attitudes towards targets of the car tax reform were mainly positive (Figure 4). Also other environmental policy measures gained several positive mentions. Fuel tax induced a lively debate and it was often considered as a potential substitutive measure to the car tax reform. The fuel tax was considered more equal and more efficient policy measure.

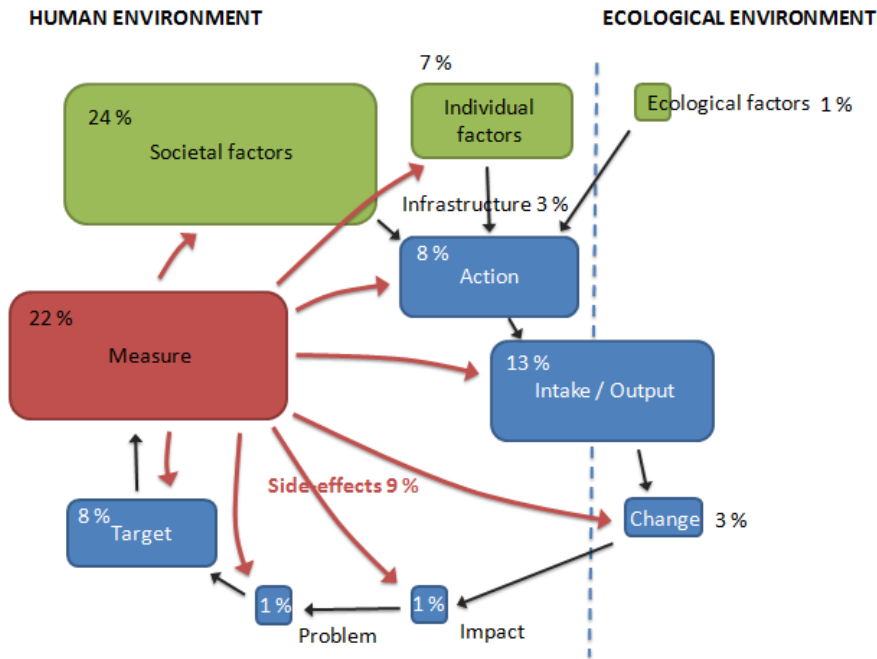


Figure 3. *The Environmental Protection Process -framework modified according to the results. The size of the boxes and percentages describe the visibility of the subject in the newspaper.*

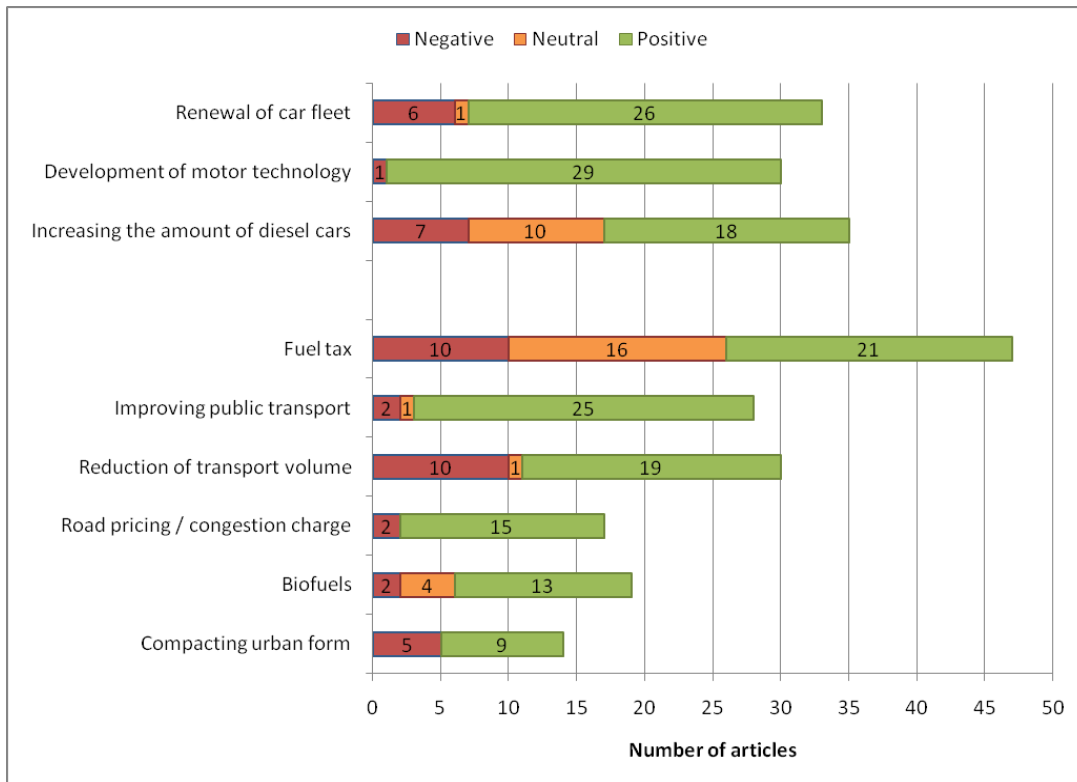


Figure 4. *Attitudes towards different policy measures. The uppermost three measures were targets of the reform. The rest are other policy measures mentioned in the discussion.*

Future orientation of the discussion appeared to emphasize short-term impacts over longer temporal perspectives (Figure 5). In substantial proportion of articles, especially in the letters to the editor, the future orientation was totally absent. Near future was the most common temporal perspective of the articles. Editorials seemed to focus also to longer time perspectives.

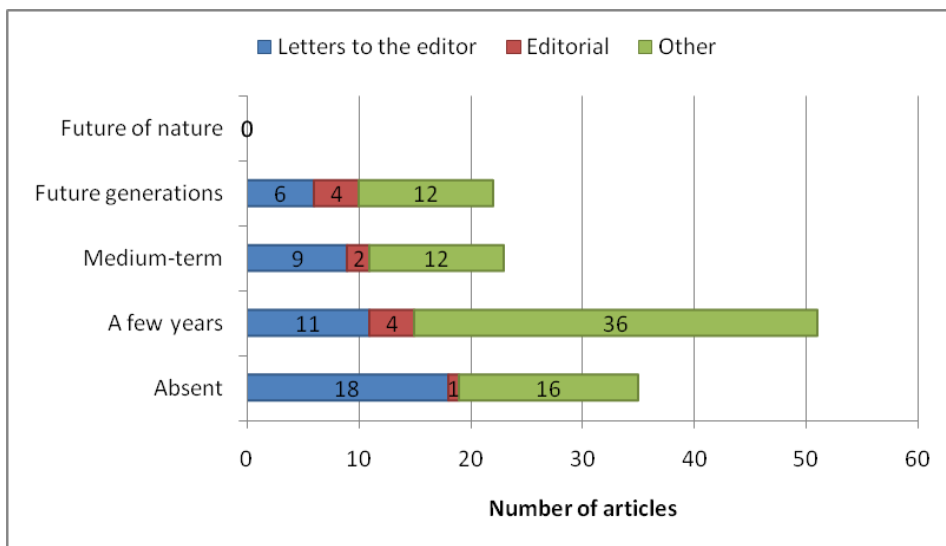


Figure 5. Future orientation in different newspaper sections.

4. Discussion and Conclusions

The car tax reform was considered as an effective policy measure to solve environmental problems caused by transport by the majority of the newspaper articles. Although there are several drawbacks of the reform, e.g. potentially growing car fleet as well as increasing emissions of particles and nitrogen oxides due to growing amount of diesel cars, the reform was prejudged and framed as an effective environmental policy measure. Especially the editorials promoted the reform, while the letters to the editor presented more critical views of the effects of the reform.

The actual impacts of the reform have been fairly modest. The discussion was focused on unit emissions measured by emissions relative to traveled distance and not on total emissions measured directly. When the actual data is looked at, the unit emissions of new cars did decrease significantly after the reform, from 179 g/km in 2007 to 150 g/km in 2010 (Ake, 2011). However, due to the economic recession, the EU-27 average passenger car density grew only from 463 to 473 cars per 1000 inhabitants (2.2%) between 2007 and 2009, whereas in Finland it grew from 487 to 521 (7.0%), respectively, although Finland by no means remained unaffected by the recession (Figure 6). The car traffic volume grew in Finland by 1% between 2007 and 2009 although the GDP was reduced by 7.4% which is exceptional (FTA, 2011; Statistics Finland, 2011). Total car traffic CO₂ emissions were reduced by 5.0% between 2007 and 2009 (VTT, 2011), but as the economy will recover, the new cars will probably be used more in the future.

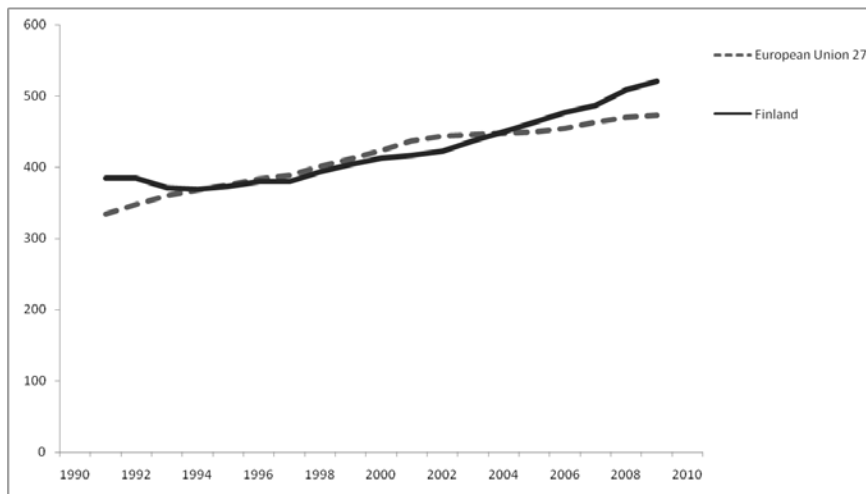


Figure 6. Passenger car density per 1000 inhabitants in EU27 and Finland (Eurostat, 2011).

The other policy measures that were mentioned during the discussion, gained quite a lot of positive mentions. Some of those may become realized in the forthcoming transport policies, although that would require a continuing and growing public pressure and demands to cut the emissions from the transport sector. Significant emissions reductions in the transport sector would require several different policy measures (Åkerman and Höjer, 2006; Hickman et al. 2010) and a comprehensive understanding of their effects. Also the other policy measures might have side-effects which are not obvious at the first glance.

In Finnish discussion on car tax reform, mainly short-term future orientation was present. As the effects of environmental problems, especially climate change, have typically long temporal impacts, it would be vital to take into account longer time perspectives in news reporting. The short future orientation contributed to conclusions that car tax reform has positive effects on the emissions reductions from transport. However, if longer temporal effects would have been taken into account, the conclusion might have been different. Especially, the rebound effects related to growing car fleet may increase total emissions even if the emissions per unit were slightly lower.

The EPP framework is a comprehensive model of creation and settlement of environmental problems (Tapio and Willamo, 2008). The different components of the model were unevenly covered in the discussion. The components concerning ecological environment gained only few mentions, while human environment concerning components, such as societal factors and measures, were highly visible. Therefore, it is evident that in the environment related car tax reform discussion, all aspects of the reform were not taken into account sufficiently.

The insufficient treatment of different components and short future orientation did not promote comprehensive discussion on the topic. Hence, the discussion probably contributed to the conclusion that car tax reform was an effective environmental policy measure based on too narrow perspective and inadequate assessment of effects. Thus, the way HS set the public agenda was a result of non-holistic discussion, where several, especially far-reaching, effects were bypassed. It appears that despite of relatively wide-ranging discussion, the media debate contributed only marginally to the public understanding of the prerequisites of sustainable transport.

The denying of planned changes to the car registration tax by some politicians suppressed the discussion on the car tax reform. As the preparation of the legislation was kept secret from the

public, there were little possibilities for public to express their views on the issue. Therefore the public opinion could be bypassed. This kind of procedure will compromise the public deliberation on important topics and is of concern on the democratic point of view.

Despite of the defectiveness of the discussion and the reform, it might still have had some impact on general carbon consciousness in transport, as the total emission reduction suggests. Carbon dioxide emissions were highly visible in the discussion for a long period of time, and that may have had some impact on “carbon consciousness” in transport, resulting in, for example smarter driving habits.

The overall amount of news items covering environment and the car tax reform was relatively low if compared with the overall amount of news items published by HS (about 6,000 news items per month). This was surprising since traffic sector is a key player in climate policies that were widely debated during the study period (Lyytimäki and Tapio, 2009; Lyytimäki, 2011) and car taxation is a subject that has a direct impact on most of the Finns. Although it is probably not reasonable to assume that the debate on taxation mechanisms would reach the level of coverage of entertainment or sports, the low overall amount can be considered as worrisome from two perspectives. First, the low level of debate does not serve the ideal of deliberative democracy. On the contrary, the media seems to serve as a tool for suppressing the citizen debate. Second, low level of coverage that is fragmented gives only little advice on consumer that on car purchase.

As emphasized by Honkasalo (2010) when planning policy instruments, it is important to call attention to what kind of benefits exist for the consumer and to understand the role of products as symbols. This is in line with Dennis’ and Urry’s (2009) vision that the car will not be substituted by sustainable modes by denial and regulation but something that is more convenient, cheaper and more fun.

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10. SUSTAINABLE ENERGY

CO₂ ECONOMY IN THE BRIC COUNTRIES

DECOMPOSITION ANALYSIS OF BRAZIL, RUSSIA, INDIA AND CHINA

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ABSTRACT – *This article analyses the factors that impact the amount of CO₂ emissions and energy use in the so called BRIC-countries, Brazil, Russia, India and China. Different factors having an effect in the greenhouse gas emissions from fossil fuels are analysed using decomposition analysis. In mathematical decomposition analysis, the observed change in explained variable is divided in meaningful components. The shares of these components can be compared and the change in the shares over time can be studied.*

We have conducted two different types of decomposition analyses. The first one is chained decomposition analysis, in which the observed change in CO₂ is decomposed to four intensity factors and an extensive factor, population. The second decomposition analysis is a structural decomposition analysis of the final energy use. In this decomposition the change in final energy use in agricultural, industrial and service sectors are decomposed into activity, intensity and structural effects.

The results of the decomposition analyses indicate on the one hand some similar trends of convergence in the three economies. This can be interpreted to be caused by the globalisation of the economic processes, which directs the production processes of the companies to develop in similar patterns. On the other hand, there are also differences in the development trends caused by the different structures of the economies.

1. Introduction

This article analyses the factors that impact the amount of CO₂ emissions and energy use in the so called BRIC-countries, Brazil, Russia, India and China. The general consensus is that the BRIC term was first prominently used in a Goldman Sachs report from 2003, which speculated that by 2050 these four economies would be wealthier than most of the current major economic powers. The BRIC thesis posits that China and India will become the world's dominant suppliers of manufactured goods and services, respectively, while Brazil and Russia will become similarly dominant as suppliers of raw materials. It's important to note that the Goldman Sachs thesis isn't that these countries are a political alliance (like the European Union) or a formal trading association - but they have the potential to form a powerful economic bloc. BRIC is now also used as a more generic term to refer to these four emerging economies.

The different factor that have an effect in the greenhouse gas emissions from fossil fuels are analysed using decomposition analysis. Decomposition analysis divides the change in CO₂ emissions in

meaningful components and compares the shares of these components. In addition to the chained decomposition analysis of five different factors affecting the emissions, we have also carried out a structural decomposition analysis of the final energy use component comparing the activity, intensity and structural effects on the agricultural, industrial and service sector energy use.

We have carried out the decomposition analysis for Brazil, Russia, India and China. These economies have a major role in future climate policy and the attempts to reduce greenhouse gases in a sustainable level.

2. Method

Advanced Sustainability Analysis (ASA) is a mathematical information system developed by the Finland Futures Research Centre. It can be used to analyze macro-economic development from different sustainability points of view (see Kaivo-oja et al, 2001; 2002; Luukkanen et al. 2002a; 2002b; 2002c; Malaska et al, 2003; Vehmas et al, 2003; Kaivo-oja, 2004). ASA focuses on analyzing changes in environmental stress (ES) or social welfare (WF) or other factors, measured with different indicators. ASA is different from other sustainability analysis methods such as “ecological footprint” or “ecological rucksack”, which strive to provide an absolute measure of the state of environmental sustainability only. ASA deals with environmental, social and economic dimensions of sustainability, and it reveals information about the direction of change - whether it is towards or away from sustainability. This makes ASA a more practical tool for policy analysis. ASA has been used to measure and analyze several sustainability-related phenomena such as dematerialization of production, immaterialization of consumption, rebound effects, sustainable economic growth and sustainable technology development rate.

The method of ASA is a complete decomposition analysis in order to divide the total change of researched variable into different components which are called factors. The sum of all identified and decomposed factors equals to the total change of variable under investigation. Different decomposition techniques have been developed mainly in the field of energy studies for modelling changes in e.g. energy use or energy intensity (see e.g. Rose & Casler, 1996; Ang & Zhang, 2000). The main features of ASA include applying the decomposition technique into sustainable development indicators and interpreting the decomposed factors as indicators either advancing or threatening sustainability. The complete decomposition method used in this study is described below.

The ASA carried out in this study identifies five different factors behind the change in CO₂ emission from fuel combustion (see Figure 1). The factors are described and interpreted in the following. The starting points in interpreting the bars presented in Figure 1 are that (1) four different time periods with a same base year (1973) are represented in the same picture, each time period with a different colour in each bar set, (2) each factor affecting the change in CO₂ emissions during each time period is presented in a set of bars, and (3) the sum of all factors equals to the total change in CO₂ emissions from fuel combustion and is presented in the last set of bars labelled “Total”.

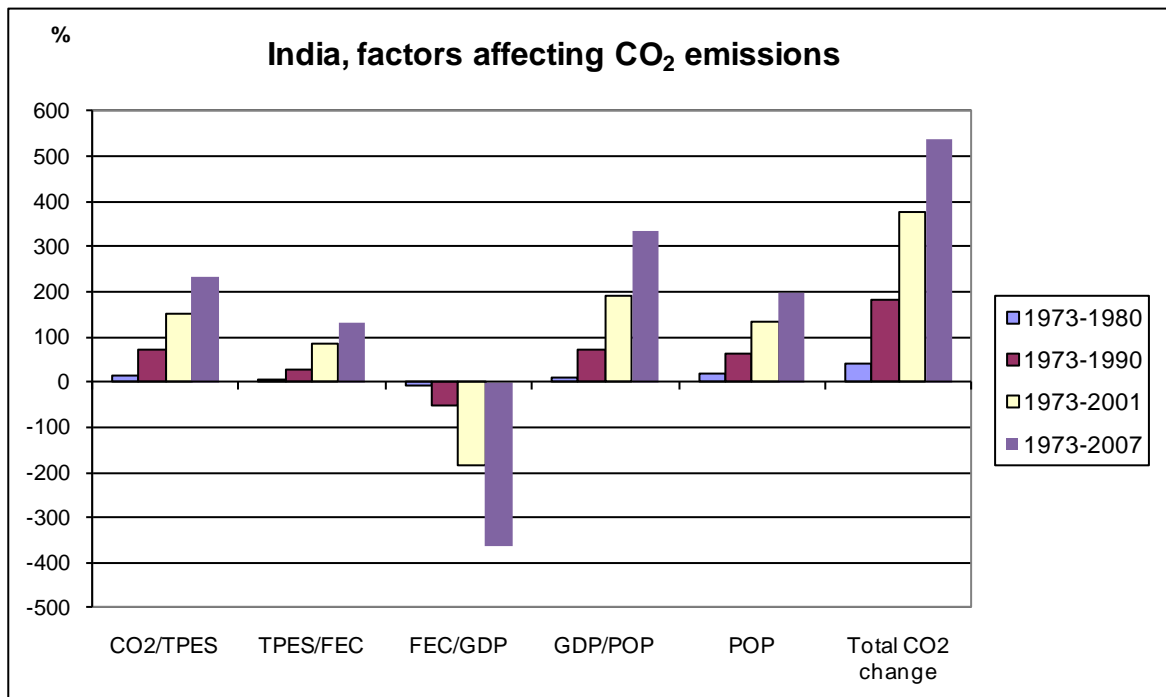


Figure 1. The effects affecting CO₂ emissions in India during the periods 1973-1980, 1973-1990, 1973-2001 and 1973-2007.

Identifying the factors behind change in CO₂ emissions from fuel combustion is based on the partition presented in the following equation:

$$CO_2 = \frac{CO_2}{TPES} \frac{TPES}{FEC} \frac{FEC}{GDP} \frac{GDP}{POP} POP$$

where

CO₂ is carbon dioxide emissions from fuel combustion;

GDP is gross domestic product in real prices;

TPES is total primary energy supply (including all fuels and other forms of primary energy, i.e. before the combustion process and transfer and distribution of electricity or heat;

FEC is final energy consumption, i.e. consumption of energy carriers such as district heat and electricity, and fuels used in residential heating and transport;

POP is the amount of population.

As a result, five different factors contributing to the change in CO₂ emissions are identified in a way that their sum equals to the total change. For the studied four time periods, all factors are calculated as a percentage of the base year (1973) value. Each bar describes the amount of corresponding factor contributing to the change in CO₂ emissions during the studied time period.

The first factor, CO₂/TPES-factor, refers to the contribution of change in CO₂ intensity of the primary energy supply, which is influenced by switch from one energy form to another. Positive values for this factor in Figure 1 imply a switch from fuels with low carbon content to energy sources with higher carbon content, e.g. from fuelwood to coal and petroleum products. Negative values would imply a decreasing effect to CO₂ emissions due to the opposite switch.

The second factor, TPES/FEC-factor refers to the efficiency of the energy transformation system, i.e. efficiency in transforming primary energy into different energy carriers such as electricity or heat. This can be influenced by e.g. switch from fuel use to electricity or vice versa, or technological changes in the

fuel combustion. Positive values for this factor in Figure 1 imply increasing use of electricity instead of other energy carriers (taking into account that the efficiency of condensing power production is usually quite low). Negative values would imply an opposite direction of change, i.e. technological changes such as switch to combined heat and power (CHP) production instead of separate heat and electricity production.

The third factor, FEC/GDP-factor, refers to the energy intensity of the whole economy. This can be influenced by several reasons such as changes in the industrial structure from energy intensive to less energy intensive industrial branches, change from industry towards services in terms of GDP shares, or technological development inside energy-consuming fields of the economy. Negative values for this factor in Figure 1 imply that India has decreased the energy intensity due to the reasons provided above. Positive values would imply an increasing effect to CO₂ emissions due change towards a more energy intensive structure of the economy.

The fourth factor, GDP/POP-factor refers to the amount of economic activity per capita which can be influenced foremost by economic growth. The positive values for this factor in Figure 1 imply that continuous economic growth per capita has increased CO₂ emissions. Negative values would imply a decreasing effect to CO₂ emissions due to decreasing GDP per capita.

The fifth factor, POP-factor refers to change in the amount of population which is influenced by birth and death rates as well as by international migration. The positive values for this factor in Figure 1 imply that quite fast population growth has considerably contributed to the increase of CO₂ emissions from fuel combustion in India. Negative values would imply a decreasing effect to CO₂ emissions due to decrease in the amount of population.

The last set of bars shows the total change of CO₂ emissions in India as a sum of the five factors presented above. Between the years 1973 and 1980 the absolute CO₂ emissions from fuel combustion has increased quite slowly, but during the time periods 1973-1990, 1973-2001 and 1973-2007 the increase in emissions has been faster. The shift to fossil fuel use, decreased efficiency of energy transformation chain, economic growth per capita and population growth have contributed to CO₂ emission growth. These factors have overrun the decreasing factor of the reduction of energy intensity of the economy resulting in a considerable increase of CO₂ emissions.

3. Results

The CO₂ emissions and emissions per capita of the economies under investigation are presented in Fig. 2. The data is from IEA (2009). In the statistics have data for China, India and Brazil starting from 1971 and for Russia only starting from 1990. The changes in the emissions show quite different trends indicating the differences in economic processes in these countries. The factors behind these different trends are analysed using decomposition analysis.

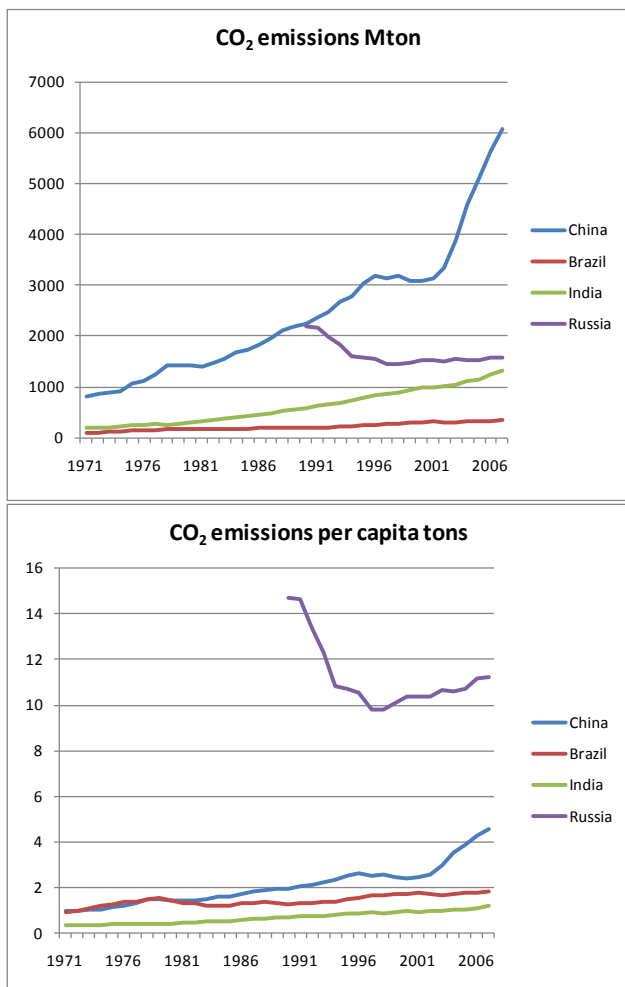


Figure 2. CO₂ emission from fuel combustion in China, Brazil, India and Russia. Data source (IEA 2009).

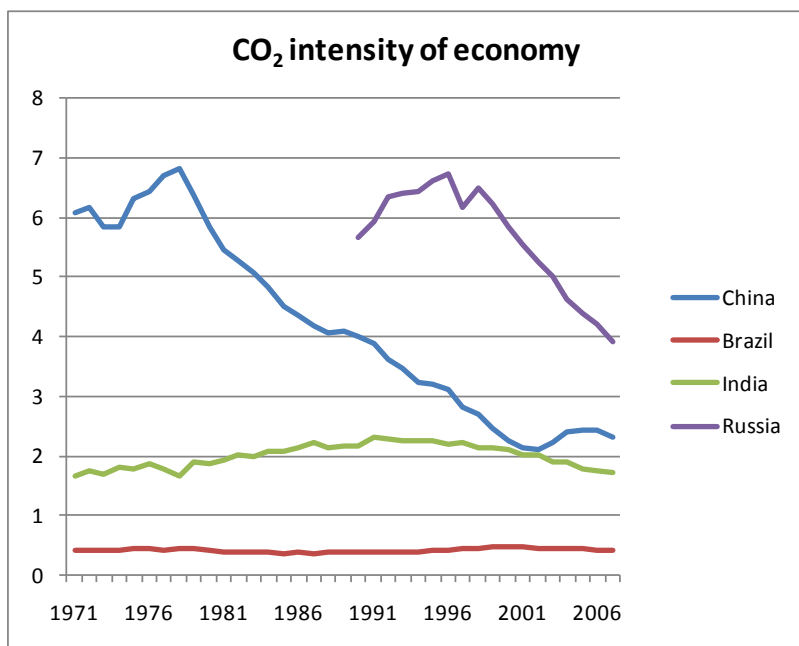


Figure 3. CO₂ intensity changes of China, Brazil, India and Russia. Data source (IEA 2009).

We analyse the changes in the countries under investigation looking at the changes in their primary energy supply and carrying out decomposition analysis of the CO₂ emissions. Because one of the main factors decreasing the emissions is the decrease in energy intensity of production (FEC/GDP effect) we have carried out a decomposition of the structural change in the economy in order to see how the structural change affects the final energy consumption.

Brazil

When we look at the primary energy sources in Brazil in Fig. 4 we can identify considerable changes in the use of different energy source.

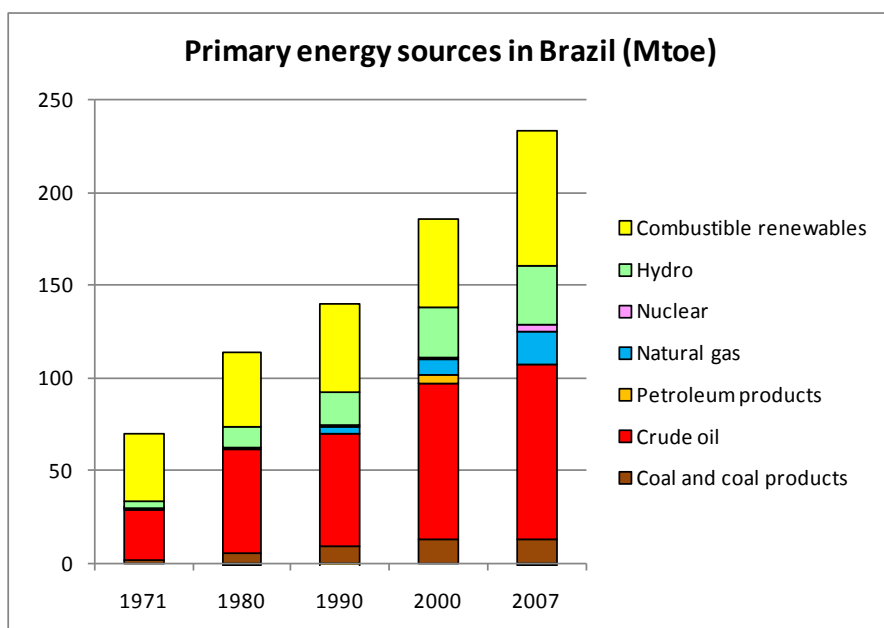


Figure 4. Primary energy sources in Brazil 1973 – 2007 (IEA 2009).

The use of oil has increased considerably in Brazil even though its share has not increased after 1980. There is also increase in coal use and natural gas use leading to increase in CO₂ emissions. The share of renewable energy has been quite high in the Brazilian energy mix and the use of biomass based energy is high in international comparison. The use of hydro electricity has also increased considerably.

If we look at the factors affecting CO₂ emissions as a result of decomposition analysis in Fig. 5, we can see that the population growth together with economic growth have been the major drivers in increasing the emission. Also the shift to fossil based energy has been increasing the emissions as can be seen in the factor CO₂/TPES. The energy transformation chain (mainly electricity production and refineries) has also contributed to increased emissions. This is mainly due to the increased share of electricity in the final energy consumption (see Fig. 6) and the 'normal' low efficiency of thermal electricity production.

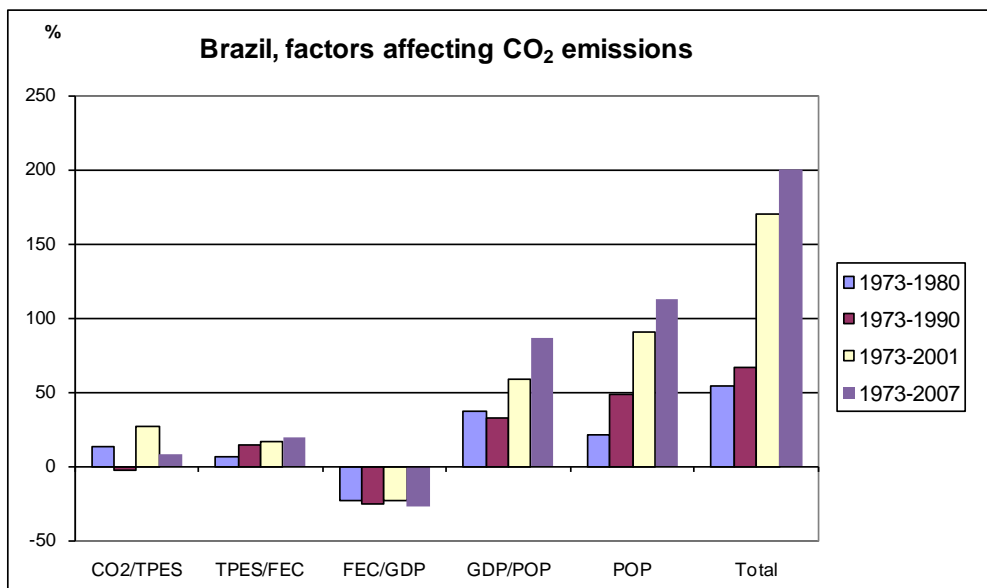


Figure 5. Decomposition analysis of the different factors having an effect on CO₂ emissions in Brazil. Percentage changes from the 1971 emission level.

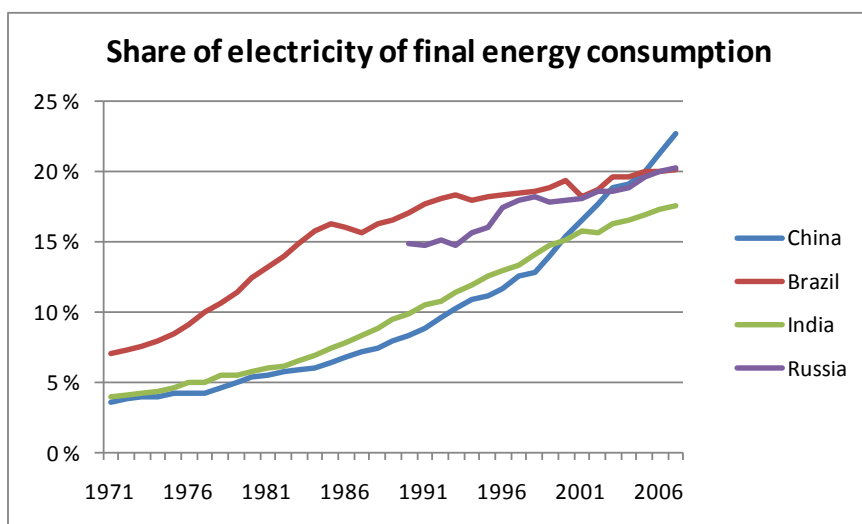
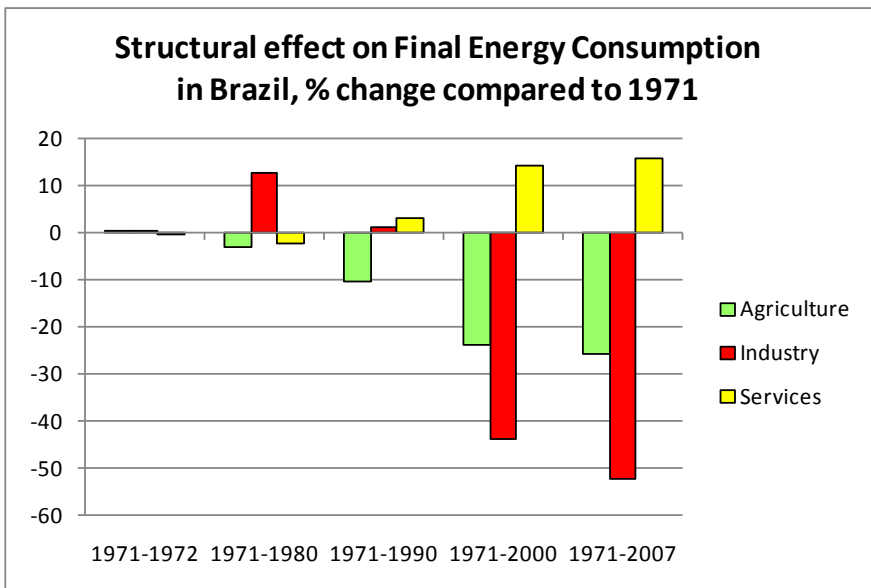
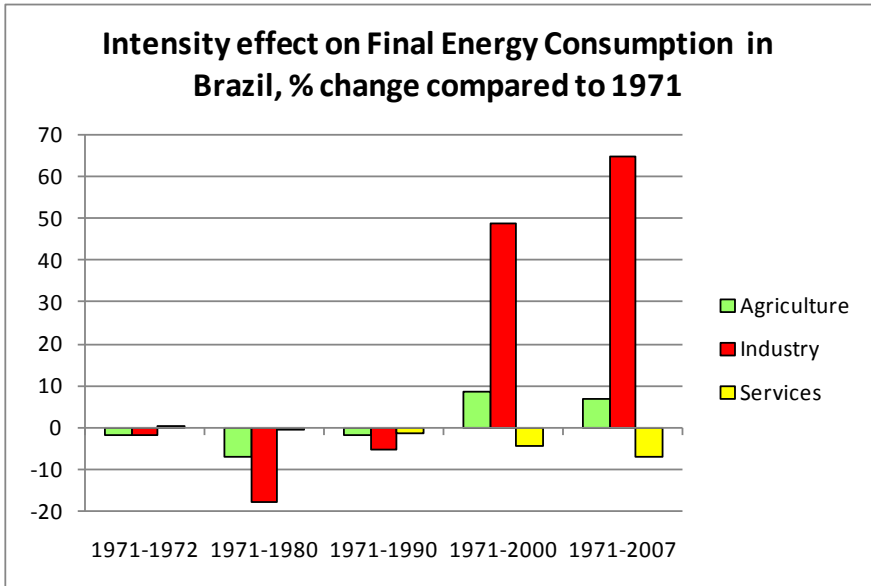
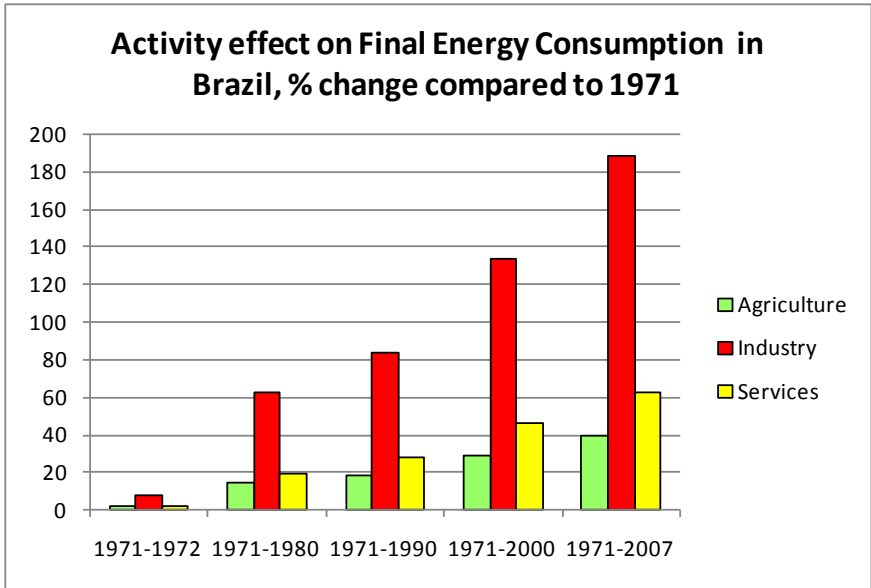
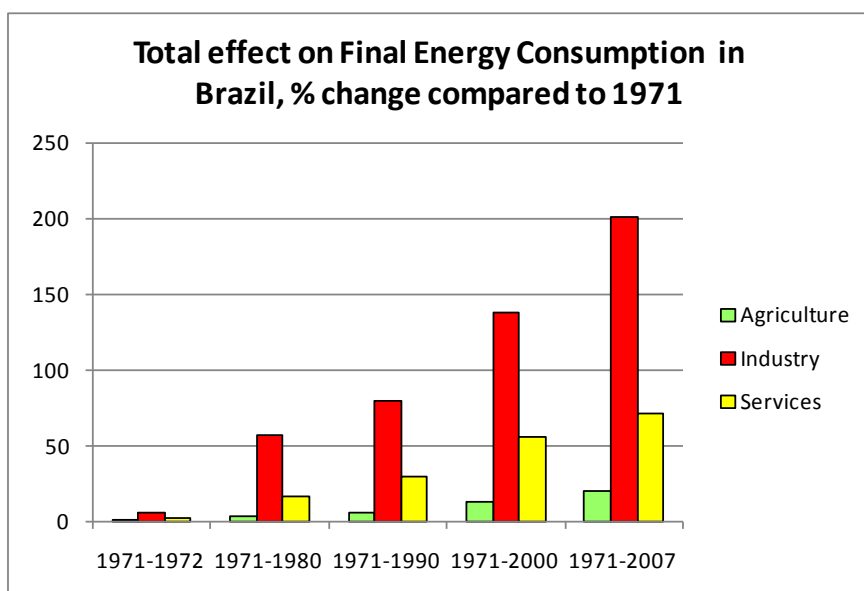


Figure 6. Share of electricity in total final energy consumption in the analysed economies (calculated from IEA 2009 data)

The structural decomposition of Brazil (using sectoral analysis of $FEC = FEC/GDP * GDP$) reveals how the changes in economic structure have affected the final energy consumption (Fig. 7). On the one hand the structural decomposition of FEC in Brazil indicates that the activity effect as well as intensity effect have increased the industrial energy use. On the other hand the structural effect has reduced the industrial energy use considerably in the 2000's. It seems that the energy intensity of the industrial sector has increased rapidly in the 2000's due to the structural change within the industrial sector. The structural effect indicates a remarkable change in Brazilian economy which has shifted the emphasis from industrial and agricultural production to service sector. The analysis indicates that the growth of service sector has started in Brazil and will probably be an important economic transformation that will take place also in the future.





Figures 7a, b, c, d. Activity, Intensity, Structural and Total effects on Final Energy Consumption in Brazil in different sectors (Agriculture, Industry and Services) of the economy.

Russia

The use of primary energy sources in Russia are shown in Fig. 8. The data is available only back to 1990, since the statistics before that were for Soviet Union. The total energy use in Russia has decreased from the old soviet level in 1990 after the remarkable economic transitions that have taken place. Russian energy system is relying on fossil fuels, which is quite understandable taking into consideration the huge resources the country has. Natural gas is still the dominant energy source in Russia.

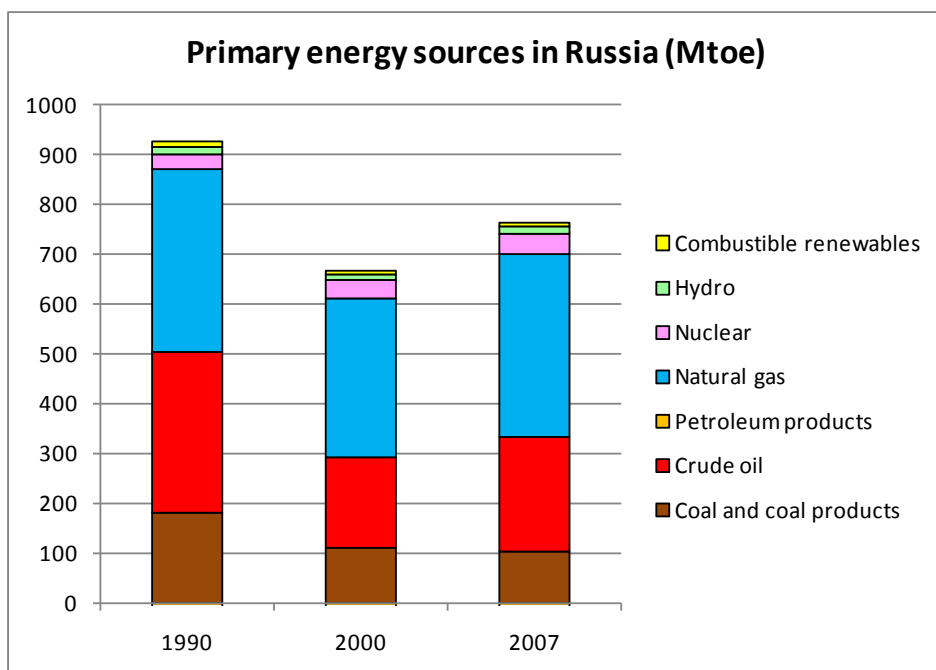


Figure 8. Primary energy supply in Russia (IEA 2009).

When we look at the factors that have affected the CO₂ emissions in Russia after 1990 we can see that the economic development (GDP per capita) and the huge drop in GDP after the collapse of Soviet Union

has had considerable impact on CO₂ emissions. The CO₂ emissions in 2007 were about 30 % lower than in 1990. The shift to fuels with lower carbon content has reduced the emissions a little (CO₂/TPES) while the shift towards increased share of electricity in the final energy consumption (see Fig. 6) has contributed to the increasing component of TPES/FEC: The energy intensity of Russian economy (FEC/GDP) has reduced remarkably in the 2000's decreasing the emissions. Also the decrease in population has contributed to reduction in emissions.

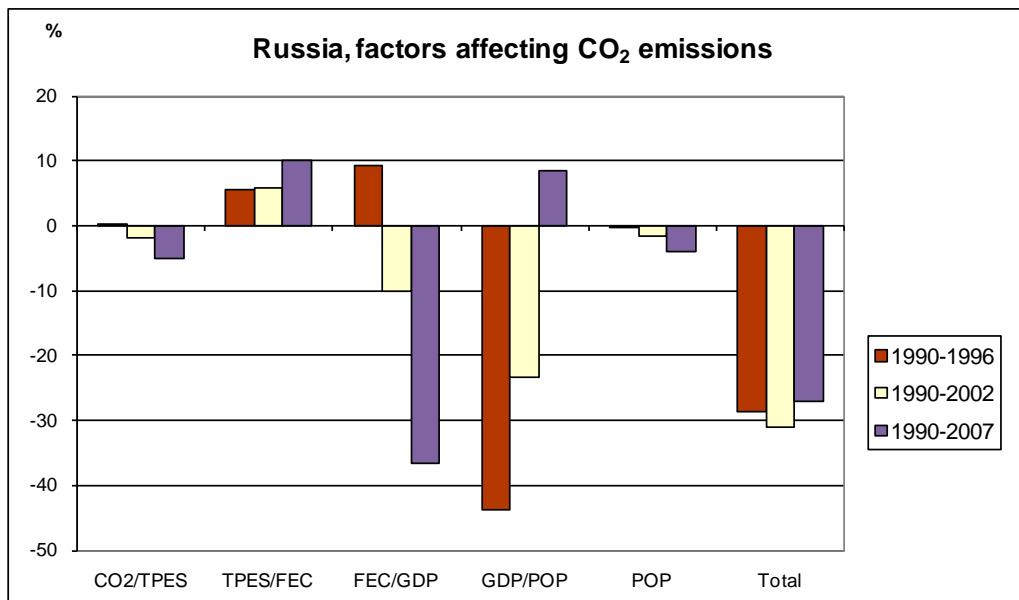
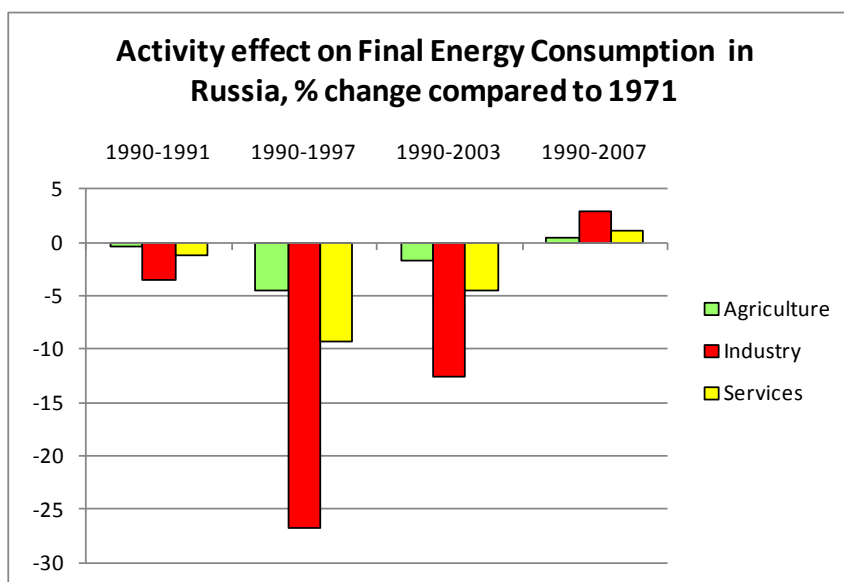
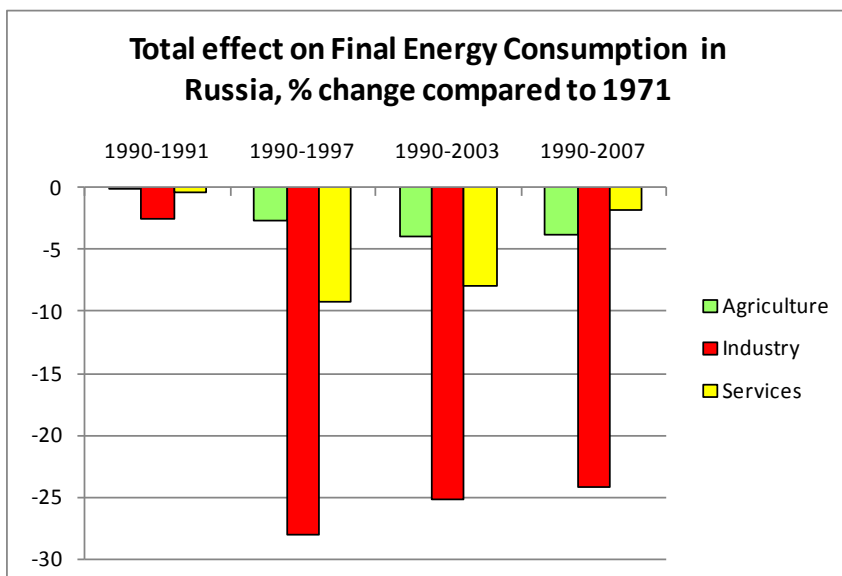
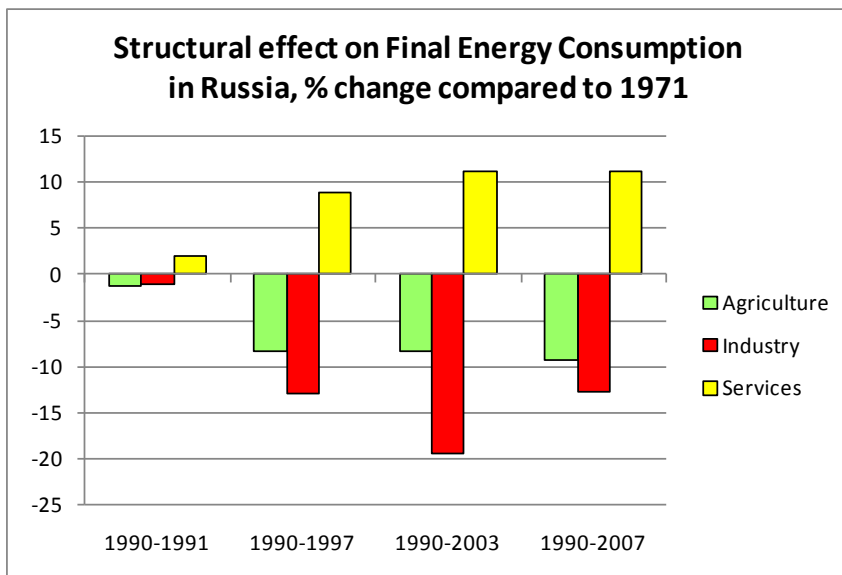
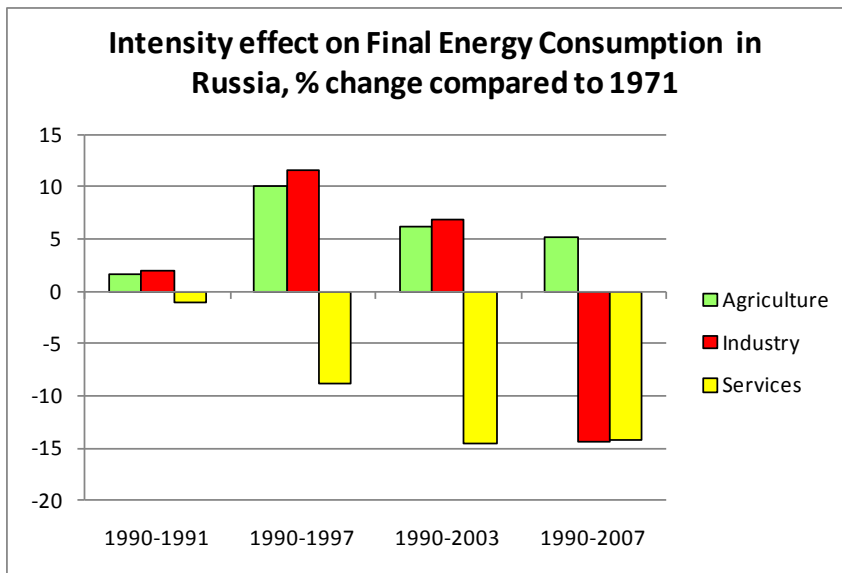


Figure 9. Decomposition analysis of the different factors having an effect on CO₂ emissions in Russia. Percentage changes from the 1990 emission level.





Figures 10a, b, c, d. Activity, Intensity, Structural and Total effects on Final Energy Consumption in Russia in different sectors (Agriculture, Industry and Services) of the economy.

The structural decomposition analysis for Russia indicates that the activity effect has been mainly reducing final energy use except for the later 2000's. The intensity effects in agricultural and industrial sectors have increased energy use except for industry in the later 2000's. The energy intensity in the service sector has contributed to the reduction of energy use throughout the examined period. The structural effect indicates a clear trend towards service oriented economy. This is remarkable when we estimate the future development of Russian economy and its CO₂ emissions. The total effect of Fig. 10d shows that the changes in industrial production have been most important in reducing the energy consumption of the economy.

India

The strong growth in coal and oil consumption in India (as shown in Fig. 11) has mainly contributed the increase in CO₂ emissions. Even though the use of renewable energy has grown its share has decreased from over 63 % in 1971 to 29 % in 2007 it still forms a considerable amount of energy compared with many other countries.

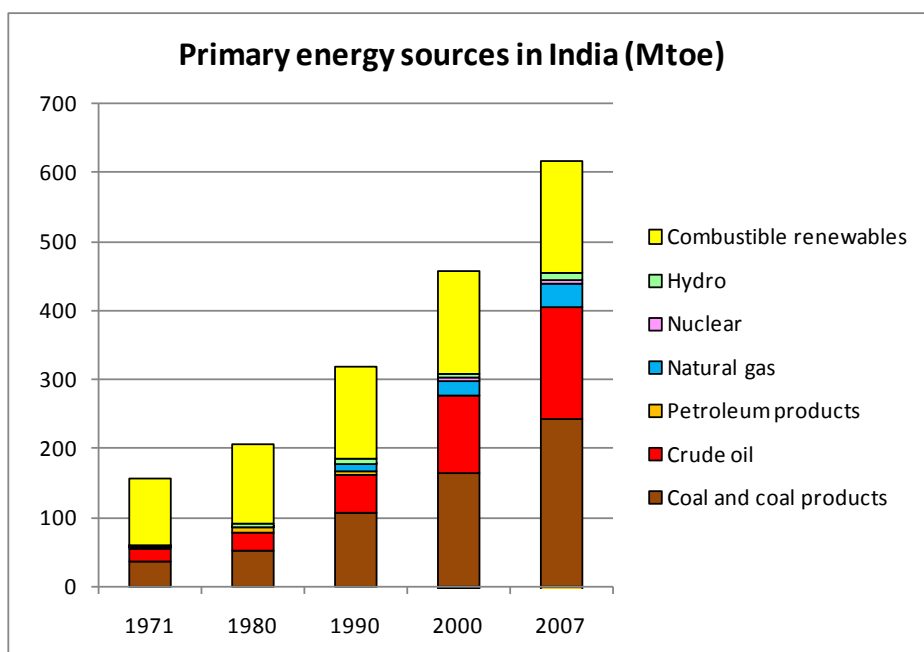


Figure 11. Primary energy sources in India (IEA 2009).

The decomposition analysis of factors affecting the CO₂ emissions in India is shown in Fig. 12. The percentage figures are remarkable due to the very low starting level of emissions in the year 1971, which serves as the reference value. The analysis indicates considerable shift towards fossil fuels as can be seen in Fig. 11 and the CO₂/TPES factor in Fig. 12. The decrease of efficiency in the energy transformation processes (indicated by TPES/FEC and caused mainly by the increasing use of electricity, see Fig. 6) has also contributed to the increase in emissions. The decrease of energy intensity of production has been the only contributing factor decreasing emissions. Economic growth (GDP per capita) and fast population growth have contributed in increasing the emissions.

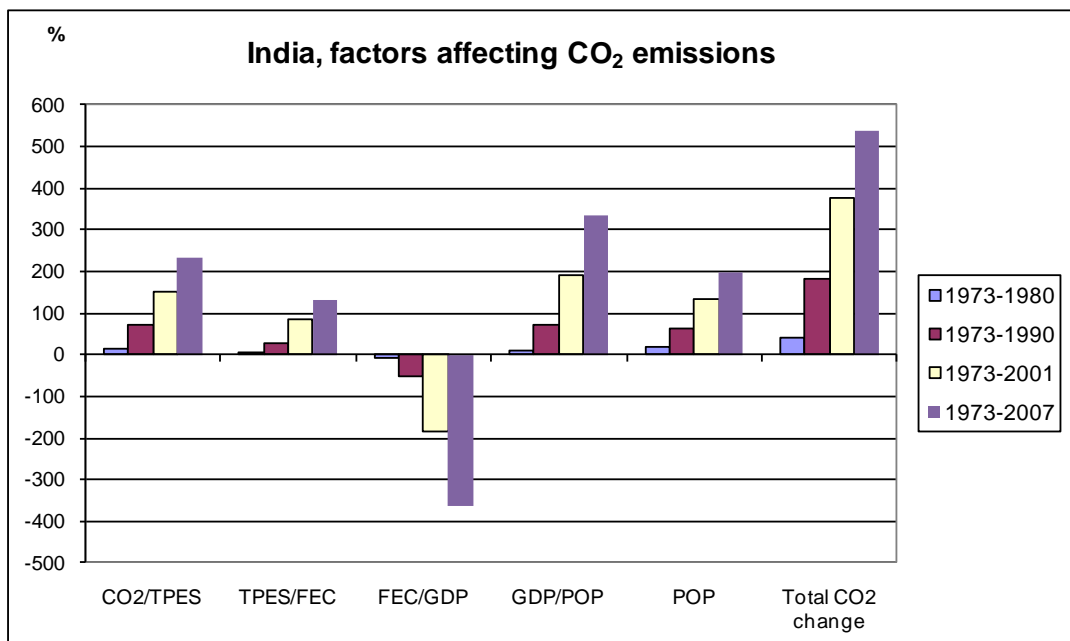
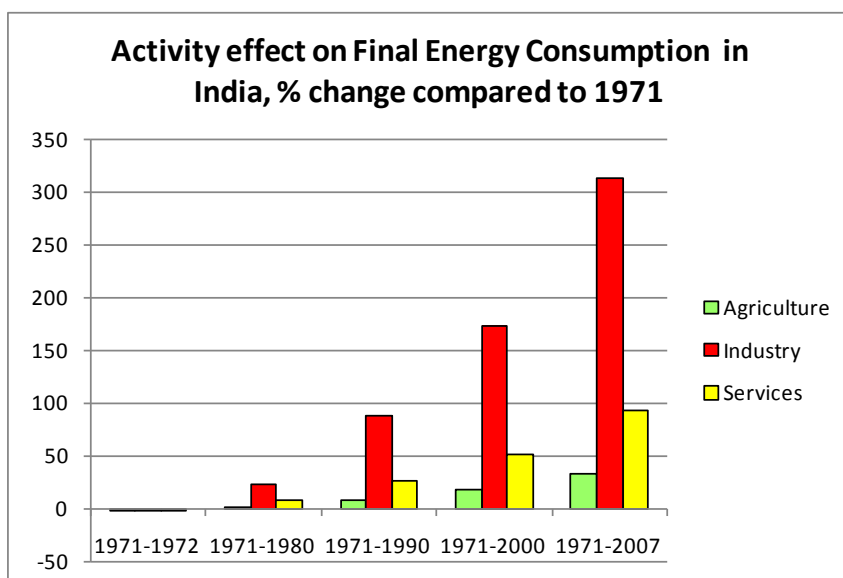
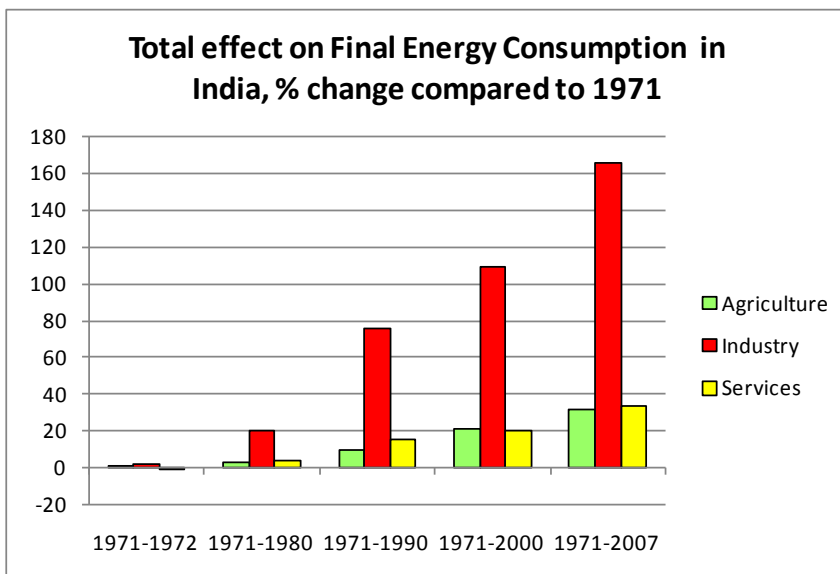
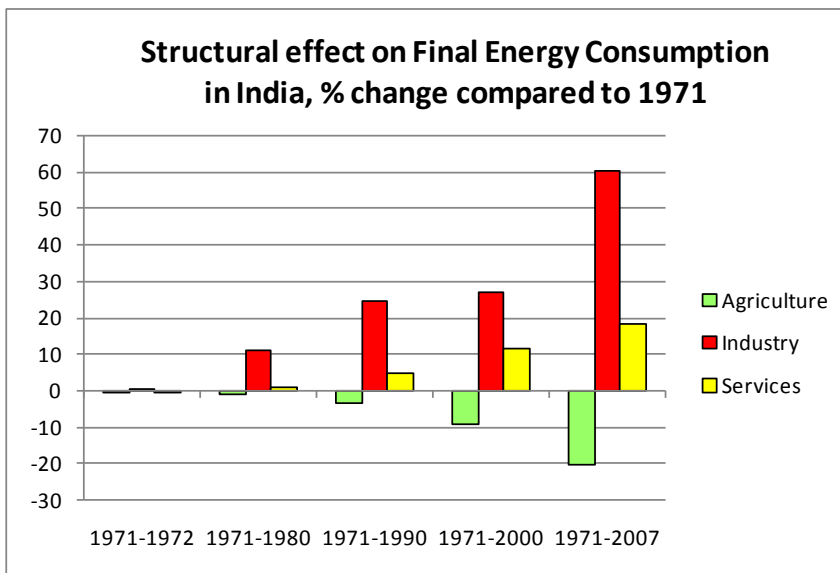
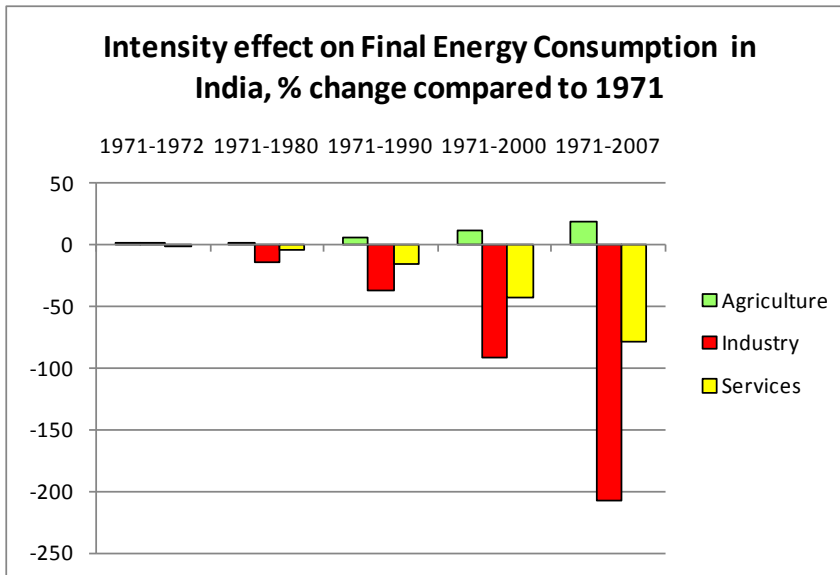


Figure 12. Decomposition analysis of the different factors having an effect on CO₂ emissions in India. Percentage changes from the 1971 emission level.

The structural decomposition analysis results for India are shown in Fig. 13. The activity effect indicates growth for all sectors with industry dominating while intensity effect shows the considerable reduction in energy intensity in services and industry. The structural effect clearly indicates the importance of industrial growth in India while the total effect shows that all the sectors have contributed to the growth of energy use.





Figures 13a, b, c, d. Activity, Intensity, Structural and Total effects on Final Energy Consumption in India in different sectors (Agriculture, Industry and Services) of the economy.

China

The primary energy sources in China are shown in Fig. 14. The importance of coal use can easily be seen from the figure. The increasing use of coal has had a distinct impact on the CO₂emissions as well as the increasing use of oil especially in the transport sector. It seems that until 2007 there has not been much increase in the use of renewable energy.

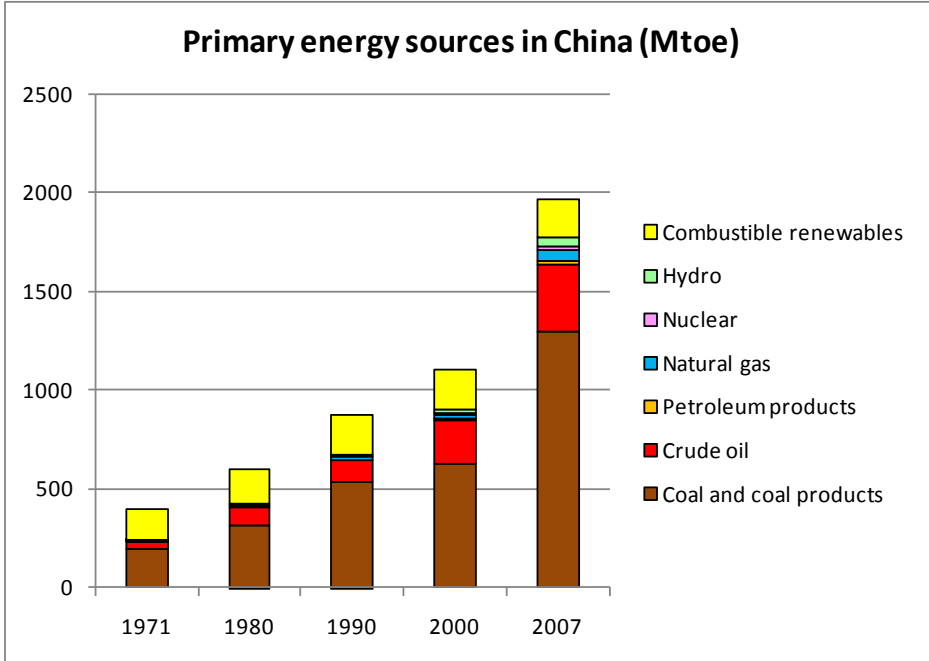


Figure 14. Primary energy supply in China. Data source (IEA 2009).

The results of the decomposition analysis of factors contributing to the CO₂ emissions is shown in Fig. 15. Again here the percentage figures are remarkably large due to the very low starting level of emissions in the year 1971, which serves as the reference value. The shift to fossil fuel dominated energy system can be seen in the factor CO₂/TPES. Also the shift to increased electricity share of final energy consumption is observable in the component TPES/FEC: On the one hand, the energy intensity of the Chinese production system has decreased considerably contributing to the reduction of emissions but on the other hand, the huge economic growth and population growth have contributed in increasing the emissions.

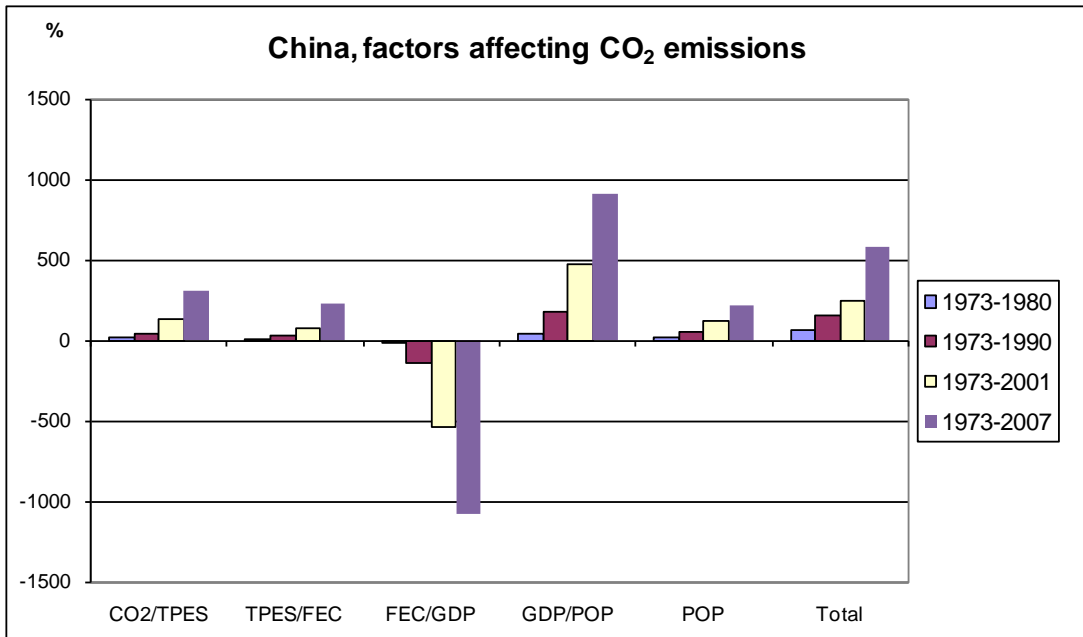
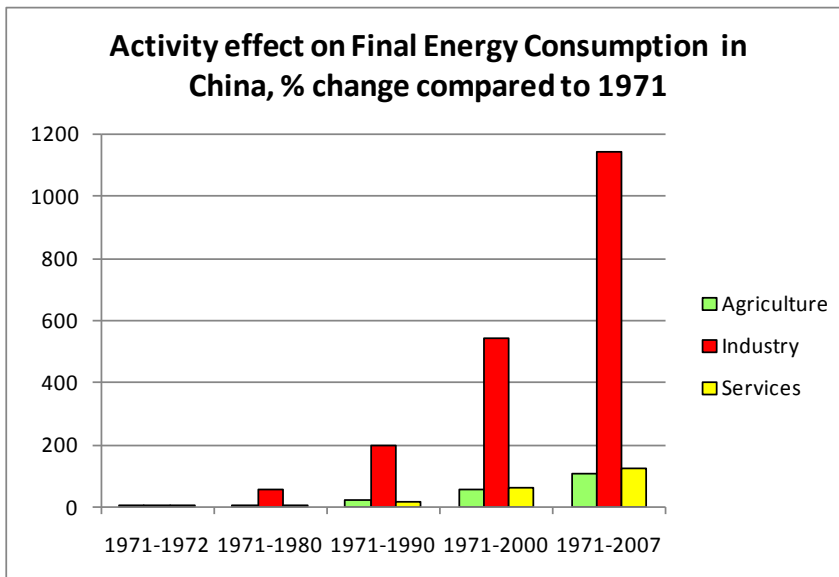
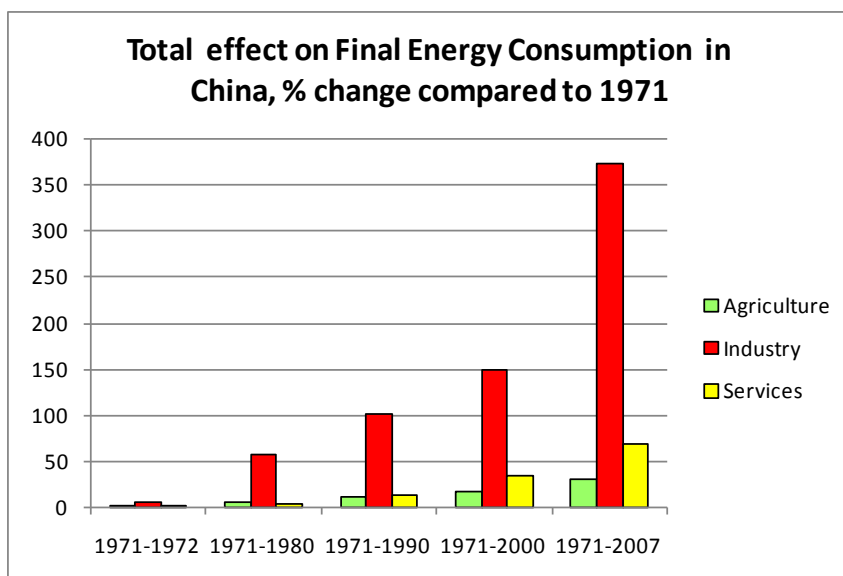
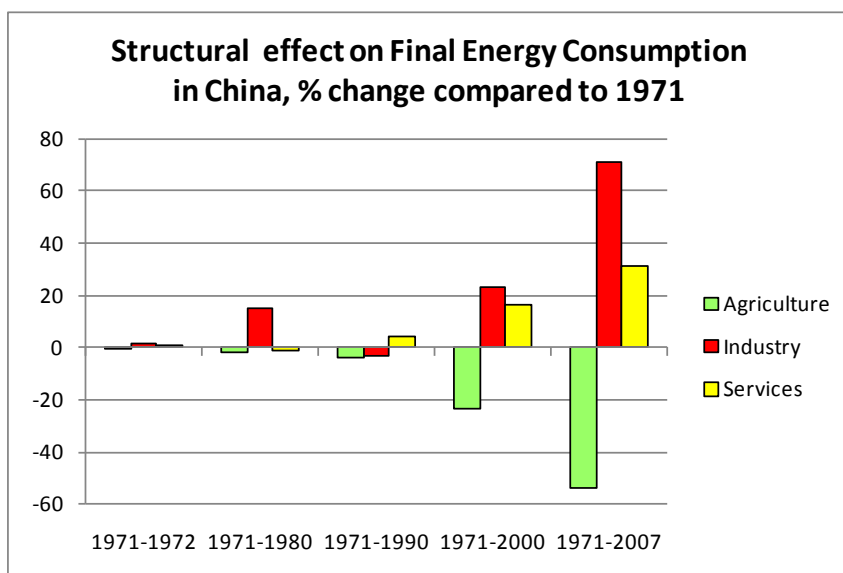
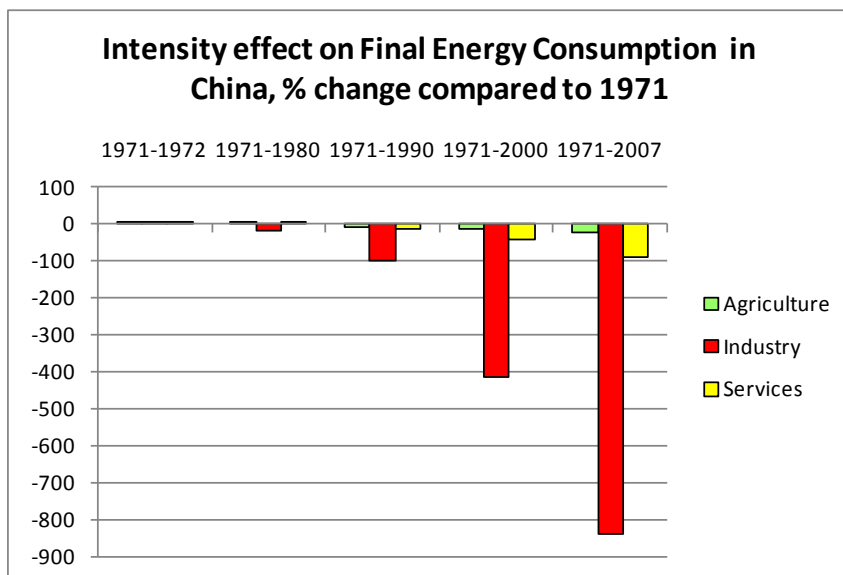


Figure 15. Decomposition analysis of the different factors having an effect on CO₂ emissions in China. Percentage changes from the 1971 emission level.

The results of the structural decomposition analysis for China are shown in Fig. 16. The domination of industrial growth as a contributing factor on growth in energy consumption can be easily seen in the activity effect figure. On the other hand the improvement of the energy efficiency in Chinese industrial production can be seen in the intensity effect. The structural effect indicates the growth of industrial and service sector and the relative reduction of the agricultural sector.





Figures 16a, b, c, d. Activity, Intensity, Structural and Total effects on Final Energy Consumption in India in different sectors (Agriculture, Industry and Services) of the economy.

4. Conclusions

The decomposition analysis of the energy sector in the BRIC countries Brazil, Russia, India and China provide interesting results about the factors behind the changes in CO₂ emissions. On the one hand the trends of these four emerging economies are different in the development of the general CO₂ intensity of economy. In some countries the CO₂ intensity is increasing and in some decreasing. However, there seems to be also a converging trend, which can be interpreted to be a result of the modernising and globalizing trends of the economies in the world. To be able to be competitive in the global markets different actors have to modify their production processes to be similar. On the other hand the decomposition analyses indicate considerable differences in the trends of production structures in these economies. As a result it can be concluded that even though the production processes in competing companies converge the production structures of the economies do not converge, or converge in a different time scale.

The structural decomposition analyses indicate that the intensity effect in all the economies reduces the final energy use except in Russia in the 1990's and Brazil industrial intensity, which increased considerably in the 2000's. There are differences in the performance of the economic sectors. Generally the industrial and service intensity effects reduce energy use (and in this way CO₂ emissions), but the agricultural intensity effect often increases the energy use.

The structural change effects on the final energy consumption also differ in the economies. In all the economies the structural effect has reduced the agricultural share. In Brazil and Russia the structural effect has also reduced the industrial share. In India and China the industrialization process seems to be a major trend and this has increased the share of industrial output. The service sector has increased its share in all the economies contributing to the increase of energy use.

The developed methodology of combining the chained decomposition analysis of CO₂ emissions to the structural decomposition of energy use (as one component affecting the CO₂ emissions) seems to provide a lot of new insights in the analysis of factors affecting CO₂ emissions. Having a deeper insight in the structural changes of the economies provides advanced possibilities for understanding the factors that have to be taken into account in the policy planning.

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MICROALGAE AS A BIOFUEL FEEDSTOCK: RISKS AND CHALLENGES

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ABSTRACT – *From sustainability perspective, the potential risks associated with microalgae-based biofuel (MBB) production will be investigated in this paper, including environmental, economic, social and cultural dimensions. Environmentally, four main concerns are mapped out: firstly, there exists potential water safety risks, such as water resource abuse, regional pollution caused by downstream, groundwater recharge deficiency, etc.; secondly, unreasonable construction will lead to land use overexpansion, land pollution and service expectancy reduction; thirdly, it may exert a detrimental effect on local ecosystem, causing algal blooms and biological invasion; finally, it may emit unexpected greenhouse gases (NO_x, CH₄). From an economic risk standpoint, MBB production requires overwhelming investments due to expensive start-up establishment and more people may be unemployed because of increased automation. Socially, contaminant discharge will threaten the health of local animals and people, and over time microalgae may become the medium for mosquitoes to spread disease. From cultural point of view, it requires time for people in developing countries to adapt MBB to their daily life as an alternative to conventional fossil fuel. Taking the above challenges into consideration, efficient government policies, proactive company behaviors and positive public participation will play an important role in minimizing or even eliminating these potential risks.*

Keywords: *Microalgae, Biofuel, Impact, Risk, Challenge*

1. Introduction

There has been ever-increasing demand for diesel supply in the world. In European countries especially Austria, Spain, France and Italy, market share of diesel-based cars has exceeded 50% since 2006 (Neste Oil, 2006). Based on the current consumption of about 11.6 million tons of crude oil per day, it is expected that the entire resources can only suffice for a rather short time period (Shafiee & Topal, 2009; Vasudevan & Briggs, 2008). Analyzing global oil depletion, the UK Energy Research Centre even made a conclusion that a peak of conventional oil production will be reached between 2020 and 2030 when well-available resources will be used up (Sorrell et al., 2009). However, new oil and gas reserves have constantly been found. The most exciting discovery is that new geological surveys show that as much as a fifth of the world's undiscovered but exploitable gas and oil reserves lie under the Arctic ice (McCarthy,

2008). In this situation, potential oil and gas refining will increase fossil fuel reserves, thus causing the risks of the exponential rise of greenhouse effect, which can result in all kinds of catastrophes to our planet Earth and its inhabitants. One of the evidently exiting problems is that the high number of on-road diesel vehicles implies that emissions from the engines contribute significantly to the atmospheric levels of the most important greenhouse gas, CO₂ and other urban pollutants such as CO, NO_x, unburned hydrocarbons, particulate matters and aromatics (Kalam et al., 2003). To confront the global climate changes, biofuels (biodiesel, bioethanol, biogas, etc.), as a renewable and alternative energy, are developed and being put into practice.

Under the above background, microalgae have overwhelmingly received a lot of attention as a new biomass source for the production of biofuel. Several strengths account for the reasons why microalgae can be utilized as one of the most promising biofuel feedstock. First, microalgae have high photosynthesis efficiency and can grow very fast. Chisti (2008) illustrates that microalgae can produce many times as much oil as the other materials (e.g. soybean, corn, rapeseed, palm, sunflower) per unit of growing area every year. Second, microalgae can be cultivated without occupying farmlands (Aikins et al., 2009), and thus can reduce the possible damage to the agricultural ecosystem and the traditional food webs. Third, fresh water is not essential and nutrients can be supplied by wastewater (Mulbry et al., 2009; Wang et al., 2009) and CO₂ by combustion gas (Wang et al., 2008) during cultivation. Fourth, they can be collected very quickly, obviously accelerating the biodiesel production process (Avagyan, 2008). Fifth, the property of their uniform cell structure with no bark, stems, branches or leaves make the commercial production attractive (Avagyan, 2008), thus making the operation and control of reproduction conditions much more practical. Finally, the physical and fuel properties of biodiesel from microalgal oil in general (e.g. density, viscosity, acid value, heating value, etc.) are comparable to those of fuel diesel (Miao & Wu, 2006).

Recently, microalgae-based biofuel (MBB) has been enjoying a surge in popularity since it has become one of researchers' keenest interest in energy field and most of their studies have been focused on the following aspects: 1) microalgae culture system, including raceway, photobioreactor (PBR) and fermenter, 2) collection, screening and classification of microalgae, 3) biochemical and physiological studies on lipid material production, 4) molecular biology and genetic engineering, and 5) system analysis and resource assessment. Plenty of relative findings and technological breakthroughs have been obtained until now, theoretically and/or empirically. And most of them have been emphasized on the positive strengths of implementation of microalgae as a biofuel feedstock, such as available biomass, high oil content, carbon neutral, etc. However, there is limited detailed published information available on the sustainability concerns or risks related with MBB production.

2. Purpose and perspective

This is an exploratory study and the purpose of this research is to map out the environmental, economic, social and cultural risks of MBB production from sustainability perspective. Identifying the core environmental, economic, social and cultural impacts associated with microalgae biofuel production is the first step in supporting the development of a sustainable biofuel industry. This is especially important for the following two reasons: for one thing, today more than ever before, unpredictable environmental issues strongly bound with the economic, social and cultural impacts of the energy sector

are dominating the international agenda; for another, the analyses point out the unsustainable aspects of MBB production, so that they can be forecast in advance and then either mitigated or eliminated to some degree during its production.

Recently, researches on MBB production in this field are booming, but by far none of them explains the environmental, social, cultural and economic dimensions involved with potential sustainable risks. For example, Ketola (2010) only roughly pointed out or summarized some environmental social, cultural and economic impacts of algae utilization when she took algae as an example when analyzing the interrelations between food, energy and water issues. In this paper, from sustainability perspective, the authors try to explore the potential risks and challenges connected with the production of MBB, systematically and explicitly, including environmental (water, land, biodiversity, and greenhouse gases), economic, social and cultural dimensions. Afterwards, some corresponding recommendations concerning government policies, company behaviors and public participation are put forward in order to minimize the potential risks to the permitted levels.

3. Potential risks and challenges

3.1. Environmental effects

In order to illustrate environmental sustainability of MBB, this section will identify four core areas of potential environmental interest – water, land, biodiversity, and greenhouse emission – and will analyze their vulnerability to degradation or unsustainable utilization from commercial-scale microalgae-to-biofuel production processes.

3.1.1. Water

During various MBB production processes from microalgae cultivation to biofuel extraction, water resource is indispensable, and its management mainly concerns about three levels: water utilization, downstream water, and groundwater.

Demands on water for commercial MBB production can present tremendous challenges for microalgae biofuel development, especially in water-constrained regions. Without feasible water usage planning amid microalgae-to-biofuel production processes, water could not be taken advantage of effectively or even could be squandered. However, it is pretty reasonable to anticipate how much water needs to be managed and/or recycled, which will profoundly affect the scalability and sustainability of MBB production. For instance, land-based microalgae cultivation systems will suffer from significant water loss as a result of unpredictable evaporation (Kovacevic & Wesseler, 2010), during which water is removed but the salts are left behind (Qin, 2005). Consequently, sooner or later microalgae growth will be reduced due to the salt accumulation in the cultivation system. Under this situation, replenishing water (fresh water or low salt water) is necessary to be calculated or expected, and then be added into the system periodically.

There is no denying the fact that some microalgae systems can be designed specifically as one of the methods of wastewater treatment (Aslan & Kapdan, 2006; Ayhan, 2010; Shi et al., 2007). It is also widely accepted that comparing agriculture-based biofuel, microalgae-derived biofuel can significantly

improve water quality since limited fertilizers which are easily dissolved in rainwater or runoff are needed to be applied to microalgae system in order to increase biomass yields. However, systems discharge is inevitably the most highly regulated and possibly toxic component of any industrial process because it releases waste into the environment, and MBB production is of no exception. Production processes involved with chemical additives, chemical and metal flocculants, solvents, and catalysts (Schenk et al., 2008), especially within the harvest and extraction stages, will have the largest likely impacts on downstream water quality. If chemical toxicants could not be removed and the temperature of the waste stream could not be decreased to the permitted range, receiving waterways would be damaged and local residents' surroundings would be influenced terribly.

Like almost all agriculture and urbanization, the MBB production will take a dive to groundwater permeation by enhancing waterproof surface areas, and it will probably interrupt the original hydrologic cycle, so that the biological activity in the soil below will be reduced. In this way, rainwater infiltration shortage can cause inefficient aquifer recharge, which is pretty crucial to the water purification by itself, and this can even lead to the decline of water table in the aquifer. Another problem existing is that the aquifer can not be recharged effectively if water used in the whole process is mainly extracted from ground sources but released into surface water after utilization.

3.1.2. Land

The MBB production systems have much lower land quality requirements than other bioenergy activities, such as crop-based biofuel production, which makes a huge area of land accessible (Schenk et al., 2008), such as arid or semiarid earth, saline soils, infertile farm, polluted land, and other lands with low economic value. Nevertheless, insensible land design and planning will give rise to potential risks, such as earth pollution, land use overexpansion, land service expectancy decrease, soil erosion, etc.

Significant issues connected with lack of side or supplementary facilities may not be expected comprehensively in advance during system design. For example, heavy rain or flood might lead to high nutrient and high biomass overflow without any establishment of rainfall diversion facility, which would result in earth pollution.

In order to meet the feedstock demand of additional MBB production and over-pursue commercial profits, in some areas an indirect land use variation will happen probably when existing or potential agricultural land is used. This may indirectly result in land use overexpansion for biomass production to new fields, such as agro-forestlands, when the preceding consumers of the feedstock, such as food marketplaces, do not plan to decrease their feedstock demand.

Another impact of MBB production on land will be that amount of space is required for large-scale facilities construction (Bruton et al., 2009) which may bring about the occupancy of land resource, and low land use efficiency. For instance, open systems with integrated wastewater treatment sometimes require additional ponds for microalgae screening or sediment settlement. This may become even seriously restrictive in land-constrained areas where competition for land usage intensifies, since regional land with low current economic and ecologic value can be scarce.

What's more, site preparation for pipelines and production facilities involves the removal of plenty of rocks and earth. This will change soil structure and physical and chemical properties, thus it may cause soil erosion, soil compaction or hardening, and even geological hazards.

3.1.3. Biodiversity

Biodiversity is the degree of variation of life forms within a given ecosystem, biome, or an entire planet and is a measure of the health of ecosystems (Suneetha, 2010). In a balanced system, weather, predators, diseases, and availability of food sources dominate species population (Benton, 2001). Water contamination and introduction of invasive species can threaten the development and stability of biodiversity. Although MBB production can be carried out on unfertile land or other undeveloped lands, water quality and the reproduction of local plants and animals are still of vital importance.

Usually in large-scale microalgae cultivation system, chemicals and disinfectants are widely used for pest prevention, water treatment, and cleaning and disinfection of culture equipment. Likewise, during harvest and biofuel extraction, chemical additives, flocculants, catalysts, and harmful solvents are also in widespread utilization. As a result, the downstream discharge with chemical residual nutrients can lead to net increases in nutrient levels in receiving waterbody. Although the further environment effects are not yet known fully, eutrophication resulting from nutrient imbalance in water will give rise to notorious algal blooms and fish kills in the natural environment (Estrada et al., 2009; Glibert et al., 2005).

There exist over 100,000 microalgae species, only a handful of which have been well studied and adopted for widespread cultivation in aquaculture and food industry. Making microalgae culture pure is pretty difficult, which means the limitation or exclusion of natural and native species. As a matter of fact, exotic or potentially invasive microalgae species from system wastewater released into the natural environment may threaten the integrity of local and regional ecosystems since downstream may carry non-harvested microalgae cells. Undoubtedly, the movement or drift of microalgae species carries the risks on wild species (may result in terrible biological invasion), either through mosquitoes spread or competition with native species, jeopardizing the safety of native species even causing species extinction (Fritts & Rodda, 1998).

3.1.4. Greenhouse gases

Carbon dioxide (CO₂) can be obtained directly from burning fossil fuel or outside atmosphere, and either way CO₂ captured in microalgae biomass can be gotten rid of from the atmosphere, so biofuel is CO₂ neutral. But low level of CO₂ supply can cause the limitation of microalgae growth (Wang et al., 2008). In practice, extra CO₂ from combustion gas is often transferred into the culture system as a desirable carbon resource. Nevertheless, it is necessary to dispose some components that are harmful to the growth of microalgae by gas cleaning. When passing through the water phase, CO₂ will be dissolved into water, which will reduce the value of pH in water. This will require the higher quality of the gas cleaning facilities to tolerate the lower acidity. And the infrastructure will be very costly and energy intensive to meet this special requirement. Likewise, transporting CO₂ into culture system will cause lower pH, whose impacts are unexpected if it is out of control. However, if microalgae uptake the CO₂, pH goes up again. Of course, further concerns on whether waste gas should be made full use of or not in MBB production are outside of this paper.

Like other crop-derived biofuel, additional emissions of NO_x might be expected because the fuel-N is higher and/or no de-NO_x installations are used for small scale applications and because more energy (combustion) is needed to produce one unit of electricity or transport (Erisman et al., 2009).

Another unobvious but existing impact is the risk of other greenhouse gases emission from microalgae. At night or on cloudy/rainy day microalgae need to consume oxygen, and this may cause the appearance of anaerobic zone under water surface, which can bring about the emission of CH₄ and N₂O that is a 300 times more effective greenhouse gas than CO₂ (Erisman et al., 2009). Furthermore, possible microalgae biomass death caused by toxins, inhibitors, etc. will also result in the emission of these greenhouse gases mentioned above.

3.2. Economic impacts

Despite the higher oil contents in microalgae than other feedstock, such as palm, sunflower, the expenditures of extracting MBB product (ethanol, biodiesel, biogas, etc.) are even higher. The most important cost is the capital cost which usually happens in the start-up phase. Taking algal biodiesel as example, capital costs can occupy approximately 49.9% of the total costs (Kovacevic & Wesseler, 2010). As a result, it requires overwhelming investments from bioenergy companies, car industry and governments. This will possibly make the MBB uncompetitive and unaffordable, compared to the current price of fossil diesel (about \$ 3.4 per gallon in late 2010). Cost data reported in the existing publications can range from \$15 per barrel (Green Car, 2006) to several hundred dollars (Pimentel et al., 2009), depending on climate, species, growing systems and other conditions. Confronted with this situation, investors will be careful and cautious when they plan to establish a new MBB project now that they need to compare and weigh the influences of cost parameters, such as biomass yield, lipid content, capital and operational costs, energy use and other factors.

Along with the development of increased automation, labor expenditures will be reduced, but at the same time more people will be unemployed, and thus workers will suffer from economic pressure. What is more, MBB production may compete with the other traditional microalgae usages such as cosmetics, chemicals (Spolaore et al., 2006), which may create the potential depression or shrink in the original industries.

3.3. Social aspects

The shortage of trustworthy information including health and safety issues, production transparency and concerns for the environmental sustainability have been taken as the main key factors in the loss of confidence in MBB industry by communities. If chemicals like additives and flocculants are used to gather the microalgae and if catalysts and toxic solvents are utilized to extract biofuel, concerns can come to the anxiety that these substances may residue in co-products and/or byproducts (Krinsky & Johnson, 2005), thus having a detrimental effect on the health of poultry feeding on them. Inevitably, people will also suffer when they are absorbed into our body by chemical accumulation through food chain. Another public health risk is that the microalgae cultivation system may provide some habitats for laying and hatching of mosquito eggs and larvae as microalgae are a significant part of their diet (Marten, 2007). These mosquito eggs and larvae can be the main media to transmit diseases, such as malaria which kills more than 1 million people each year (WHO, 2008). In some cases, concerns have also been put forth over the potential impacts on the health of field workers.

Moreover, people attach more and more importance to the surrounding aesthetic. During system construction and facility establishment, visual effects must be taken into account, such as landscape coordination, rational layout, and so forth. What is more, attention is also paid to the impacts on the wildlife habitats subjected to varying microclimates. For example, a cute animal may fall into a cultivating pond since it may treat the green surface as broad grassland by mistake.

3.4. Cultural impact

The conception that microalgae can be used as the feedstock for food, forage, renewable chemicals (Eriksen, 2008; Oh et al., 2003) and many other products (e.g. cosmetics, vitamins) has been widely accepted all around the world for a long time. However, the MBB technology begins to strongly attract researchers' eyes only after energy crisis, so that people have limited knowledge about this booming industry. Until now, some studies on MBB are premature and relatively based on pilot scale. Consequently, the feasibility of MBB concept is essential to be verified before many projects can be deployed rapidly. In industrialized countries MBB is accessible to take into use, while people in developing countries are apt to hold the opinion that the above traditional microalgae utilization is the best choice, as microalgae biomass is a very new biofuel type to them. Therefore, it is tough for them to adapt this biomass fuel to their daily life as an option to conventional fossil fuel. As a result, it requires variable amounts of time to set up MBB production in different cultures. Moreover, most of the countries need to have more safety programs to educate and train consumers to know and understand the usage instructions now that MBB is combustible and thus dangerous.

4. Conclusions

From sustainability perspective, the potential risks and challenges associated with the production of MBB have been mapped out in this paper, systematically and explicitly, including environmental, economic, social and cultural dimensions. They are summarized in table 1.

Table 1. Potential sustainability risks and challenges of microalgae-based biofuels (MBBs).

Environmental dimension	Economic dimension	Social dimension	Cultural dimension
<ul style="list-style-type: none"> -Water resource abuse; -Damage to waterways; -Groundwater may not be recharged effectively; -Cause earth pollution, land use overexpansion, land service expectancy decrease, and soil erosion; -Exert a detrimental effect on local ecosystem, causing eutrophication, algal blooms, fish kills, and even terrible biological invasion; -Greenhouse gases (e.g. NO_x, CH₄) emissions. 	<ul style="list-style-type: none"> -Start-up phase is expensive; -Require overwhelming investments; -Loss of jobs. 	<ul style="list-style-type: none"> -Jeopardize the health of local poultry, wildlife and people; -Diseases (e.g. yellow fever, malaria) spread. 	<ul style="list-style-type: none"> -Difficult for people to adapt to

As far as environmental risks and challenges are concerned, water, land, biodiversity, and greenhouse gases are the most important points to investigate. Firstly, there may exist water resource abuse due to lack of fruitful planning, expectation and management; downstream water release without treatment will damage waterways, and over time groundwater may not be recharged effectively. Secondly, insensible land use design and planning will give rise to potential risks, such as earth pollution, land use overexpansion, land service expectancy decrease, soil erosion, etc. Thirdly, MBB production activities may exert a detrimental effect on local ecosystem, causing eutrophication, algal blooms, fish kills, and even terrible biological invasion. Finally, it may emit greenhouse gases (e.g. NO_x, CH₄) during MBB production.

Economically, the start-up phase is expensive, and it will require overwhelming investments from bioenergy companies, car industry and governments. Moreover, more people may lose jobs because of increased automation. From the perspective of society, the contamination caused by MBB production will jeopardize the health of local poultry, wildlife and people. Another public health risk is that the microalgae cultivation system may become the medium of mosquito eggs and larvae to transmit diseases, such as yellow fever and malaria. From cultural point of view, MBB is new concept especially for developing countries, so it requires time for their citizens to adapt this biomass fuel to their daily life as an alternative to conventional fossil fuel.

5. Recommendations

Undeniably, the environmental, economic, social and cultural benefits involved in MBB production have the potential to make significant contributions to a sustainable biofuel industry. However, in order to develop and commercialize a sustainable product in the long term, associated risks which commonly persist in producing process must be known and addressed through relevant measurements. Efficient government policies, proactive company behaviors and positive public participation will play an

important role in tackling with or even eliminating all kinds of potential risks existing in MBB industry. Only in this way, can MBB industry enjoy its prosperity in a sustainable manner.

From regulation and policy standpoint, there are several directions or guidelines that will push MBB development sustainably. To start with, roles and responsibilities within government agencies must be clarified in order to make sure that MBB production can operate regularly to meet the demands of marketplace. In the second place, life cycle analysis (LCA) at the biofuel product design phase must be conducted to foresee some potential risks. Then, the contracts of environmental impact statements must be reinforced and regulatory industry roadmap needs to be developed. Furthermore, international regulations, guidelines standards for sustainable biofuel must be brought in and adopted. What's more, sub-industry collaboration has to be encouraged so that investment capital can be collected more easily and the advantages of technologies can come into effect. Last but not least, the government needs to use all kinds of media to put propaganda activities into practice, covering environmental, economical, social and cultural corners.

As for company entity, the following issues should be proactively addressed. Firstly, before the establishment of MBB industry, explicit water and land use planning should be carried out in an environmental friendly manner. Secondly, in order to minimize the damage to aquatic ecosystems, relative measurements should be taken into effect to treat wastewater, maintain downstream water quality and minimize inhibitions to groundwater infiltration. Thirdly, periodicity and volumes of recycled water also need to be expected in advance, and meantime non-recycled water with high salt content should be disposed of properly. Fourthly, a careful assessment of potential risks prior to the introduction of new species should be conducted to prevent habitat damage, ecological invasion, diseases spread, etc. Fifthly, in the long run, the development of higher value co-products or byproducts is needed for the purpose of economic viability. Finally, transparency of process inputs and outputs ought to be exercised.

From public perspective, their participation will exert widely effects on the sustainable production of MBB. Public perception and participation of microalgae industry as an environmentally responsible steward will help facilitate its establishment and development. And the improvement of public sense will be beneficial to help them adopt a very positive attitude towards MBB. This can be achieved by undertaking proper communication and activities involved with government and company.

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11. SUSTAINABILITY IN DESIGN

DESIGNING SUSTAINABLE INNOVATIONS

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ABSTRACT – *This paper aims at filling a gap. The gap between the high-level vision of sustainability and innovator's and designer's everyday work in creating new technical artefacts, services, and businesses. The concepts of sustainability are reviewed in the light of established product development processes, as well as with regard to a number of current proposals for integrating sustainability in innovation processes. The paper describes a framework for the front end of innovation established at KSB Aktiengesellschaft in Germany. This framework is capable of reconciling the different notions of sustainability; simplified: "profit, people, and planet". A case study of a sustainable innovation is presented.*

1. Sustainability

Sustainability, like 'future', is being used inflationary; often as a mere buzzword by politicians and corporate managers. The designation 'sustainable business' e.g. may mean a business with a positive social bottom line or simply a business that is expected to deliver a positive cash flow over a prolonged time, dependent on the speaker. Moreover, when talking about innovations, a sustaining innovation is one that does not require the acquisition of new competencies or changes to the current business model (Christensen 2009) but lives entirely within the conditions previously established.

According to McGrail (2011) "desirable futures are increasingly seen as sustainable futures". To pick out just a few important historic milestones, the concept of sustainability - its dystopian genealogy - reaches far back. E.g. to Rachel Carson's (1962) book "Silent Spring" that helped starting the environmentalist movement to which the term sustainability is still closely linked. Another widely regarded milestone was Meadows' et al. (1972) report "On the limits to growth" to the Club of Rome. But it was not before the Brundlandt Commission in 1987, that a positive definition of sustainability was established. The term of "Sustainable Development", defined as a "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." (World Commission on Environment and Development 1987) became known to a larger audience by that time. Given that the use of a technical artefact is largely dependent on human intention and societal context and only partially determined by the design (de Vries, 2005:14-25), it is this social understanding of sustainability that poses a serious challenge to designers and engineers. This challenge is how to embody "sustainability" in a product, create the functionality wanted without the side-effects unwanted.

Hayward (2005:282-283) links the concept of sustainability to the (individual's) ability for postconventional foresight: "Environmentalism itself may be the expression of a nascent social form of

postconventional foresight. ... Environmentalism's catch cry, 'sustainability', is strikingly abstract and rarely is it made explicit exactly 'what' is to be sustained. ... Social foresight would have to chart pathways of action through multiple assessments of consequence as it is unlikely that a consequence 'free' pathway of action can be found."

In broad outlines, the approaches towards sustainability on the design side fall into three overlapping groups. The first is (eco-) efficiency, doing the same as before with less impact on the environment (this is the current sustainability mainstream: numerous corporate and political energy / water / materials / &c effectiveness campaigns bear witness to this fact). The second group is (eco-) effectiveness with closed circulation of all technical and natural materials modelled after nature's ecosystems (e.g. McDonough & Braungart, 2002 or Pauly, 2011). The third group of approaches fits under the headline sufficiency: Doing and having less (especially material wealth and economic growth) but enough for a decent living and a focus on non-material human needs. It appears that the advocates of sustainability are separated by a common language

With regard to technology the available descriptions (e.g. Vergragt, 2006; Schumacher, 2010; Raskin et al. 2002) of sustainable (appropriate, etc.) technologies in a wider sense are normative and, from an engineer's standpoint, too abstract. They do not present enough guidance for designing such technologies easily and within the established standard engineering processes. The next section will underpin this by reviewing the process perspective of corporate technology generation.

2. Design processes in Engineering

In this paper, the reference process described in VDI 2222 is chosen as an exemplar of a linearly proceeding and also widely established product development process (PDP). It is the PDP generally accepted in German industry and taught widely in universities. The successive steps (phases) towards a "product" according to VDI 2222 are¹:

1. Product planning and clarification of the task;
2. Conceptual design;
3. Embodiment design;
4. Detail design.

Another very common approach is the Stage-GateTM process (Cooper, 2003), emphasising so called gates: Decision meetings in which the product development projects are reviewed and a go/hold/kill/recycle decision is made. An overview of more process models is given by Andreassen (2005).

All of the approaches mentioned share the taylorist separation of planning and execution. Planning precedes design and design precedes manufacturing. The high cost involved in commissioning factory equipment provides a strong economic justification for this separation. In a business enterprise, this separation is mirrored too in departmental boundaries between e.g. sales/product management/marketing on one and R&D / Manufacturing on the other hand with people trained in different academic

¹ Planen, Konzipieren, Entwerfen, Ausarbeiten - translation according to Pahl & Beitz:1993.

disciplines and socialised in different departmental subcultures. While the first functions task is to specify a product, the latter design and realise it "in time, in budget, in spec".

The most important documents in any PDP are the specifications. In the planning phase, the expected demand for the product in the markets targeted is described and restrictions for the design determined. The functional specification is being written in the early conceptual design phase. At this stage, the functional specification gives a solution-independent description of the technical (!) function and expected performance of the artefact (in most cases a product) to be designed. The functional specification answers the question "What is to be designed?". The later conceptual design phase then focuses on creating alternative technological options for realising these functions and selecting these according to mainly economic criteria. Engineering design proper takes the functional specification and creates a technological artefact with the specified functions by splitting up the overall function into partial functions, finding technical solutions for each of these partial functions, and synthesizing the whole system out of these partial solutions. This concrete technological artefact is then described in the technical specification. It answers the question: "How is it designed?".

After conceptual design is finished the concept of the product is frozen. Only detail at the technical and part-level is being added from now on. Changes to the product's principle and features are made rarely, given the high cost involved in propagating any change through all affected partial functions and their concrete principles and technical instances. It is therefore clear that with regard to economic and pragmatic criteria engineering and manufacturing businesses need an ex ante approach to consider all relevant aspects of sustainability upfront. It is desirable to have sustainability considerations integrated into the PDP as early as possible. Ex post regulation or procedures directed at technologies after their creation and introduction to the market (like technology assessment) is desired least as any ex post approach may trigger changes to a finished product that come at a very high cost for the manufacturer.

Furthermore, the more radical the innovations planned are, the less they can be anticipated from outside the corporation, and the less they are accessible to ex post approaches. Given that many of today's companies consider themselves being in a global innovation-race with their competitors, the probability for radical innovations is increasing, therefore the options available for ex-post approaches and societal (often nation-state level) oversight over innovation are decreasing further.

Moreover, plans for new products, their technical and other details are most commonly strictly confidential because new products regularly aim at maintaining or increasing a firm's competitive edge. They are therefore inaccessible to outsiders. All of the aforementioned facts suggest that the best place for reconciling of the sustainabilities and anticipation of intended and unintended side effects is the product planning and design process of the enterprise.

3. Proposals for sustainability-aware innovation processes

Proposals made to the end of integrating sustainability criteria in innovation processes (Krämer, 2011; Fichter, Paech & Pfriem (Hg.), 2005; Pfriem, Antes, Fichter et al. (Hg.), 2006.) suggest measures that can be understood as 'structural deepening' (cf. Arthur, 2009:131-144) of the currently established innovation processes by adding new tools to the phases and adjusting selection criteria at the gates to create the new/added functionality required on top of the established innovation processes. But,

according to Paech (2005:259-292), these changes to details of an established innovation process will have only minor impact, unless the corporate value system and the culture changes.

According to Nassehi (2011), economic entities function according to economic purposes and therefore ask one major question only with regard to sustainability: Can we earn money with it? But what would be required by the aforementioned proposals for modified product development processes and improved selection criteria is that these economic entities adopt – at least in part – a non economic logic. Will that work in practice? How for instance will the gatekeepers in a stage-gate process deal with a new multidimensional evaluation of innovation projects including sustainability criteria? Will a sustainable but not-so-profitable innovation still be pursued once the question: “What will our shareholders say?” was raised in the boardroom? Won’t the dominant economic simply persist and wipe away the "sustainable" criteria? Is a CEO that is measured against quarterly performance in monetary terms likely to enforce sustainability induced changes that reduce profitability – even if this is a societal demand¹?

There is no way but to reconcile these perspectives. The innovator’s and engineer’s question therefore is: “Can we design the well being of nature and future generations into profitable products?” Or, at an operative level: “Is it possible for sustainability to enter the design process at the right place: The functional specification?”

4. Can we engineer sustainability?

The answer to the question is yes, if the first group of approaches towards sustainability (eco-efficiency) is taken into account; if e.g. compliance with environmental regulations is demanded. Currently established design-to-X procedures (many of which are described in the engineering textbooks e.g. Pahl & Beitz, 1993) are sufficient to accomplish this goal.

The answer is yes and no for the second group of approaches (eco-effectiveness). McDonough & Braungart (2002:165-186) provide five steps and five abstract guiding principles – on as little as 10% of the book's pages. The bridge to standard everyday engineering is largely missing. So, currently technologists or engineers whether in corporations or research know only minute parts of what is required and responsibility is diluted in the complex system a modern corporation is.

With regard to the third group of approaches (sufficiency), currently the answer is most probably no. Engineers don't know how to design sufficiency with the processes and structures established. Moreover, with regard to innovation management, sustainable innovations at the stage of sufficiency clearly require radical, not sustaining innovations.

In any of the aforementioned cases, a demand for sustainability cannot be satisfied without taking into account the corporate context and larger system(s) the product to be designed will enter.

¹ Ironically, the shareholders demanding double-digit returns are – via pension funds – in part identical with the very stakeholders that demand sustainability in other contexts.

5. Corporate context

KSB is a medium sized multinational offering pumps, valves, services and systems for numerous applications from water to energy; industry to mining with about 14,500 employees and turnover (2010) of nearly € 2 bn. (KSB 2011)

Corporate R&D is organised in a hub-and-spoke model with most of the hubs in German locations and a few abroad. The corporate mission statement includes the economic notion of sustainability, to “... achieve sustainable, profitable growth ...” (KSB 2011). The company supports the principles of the UN Global Compact.

KSB's position in the value chain is primarily that of a second tier manufacturer of standardised and engineered components that become often critically important parts of larger technical entities such as power stations, buildings, plants, or trains. This position creates a quite complex social system on the demand side. With regard to innovations, not a single buyer or "consumer", not even a buying centre but a business system with consultants, engineers, intermediaries, and other parties directly and indirectly involved is defining aspects of acceptability outside the scope of marketing or engineering. This created from the year 2000 on an increasing need for considering the larger social business-system. This need was an important co-factor in the creation of the framework described in the next section.

6. A framework for business opportunity scanning (BOS)

As a first step towards a methodology for designing sustainable innovations, the framework for business opportunity scanning (BOS) developed mostly by the author at KSB AG is proposed. In BOS, the term scanning means scanning an idea for its hidden or true potential, like in a modern imaging diagnostic apparatus e.g. a computer tomography. It is not to be confused with the 'scanning for' in trend-based ideation. The term framework is used to highlight that BOS is targeted 'one level up' from the many descriptive methodologies (how to write scenarios; how to do market research) in business, the futures field, and product development processes. It aims at designing innovations – not at designing artefacts. Framework also means that individual methods may be substituted for other methods with the same aim.

7. BOS as instance of the futures studies framework

This section highlights the key-features (cf. Table 1) of BOS using the futures studies framework (cf. Fig. 1) by Keller (2009).

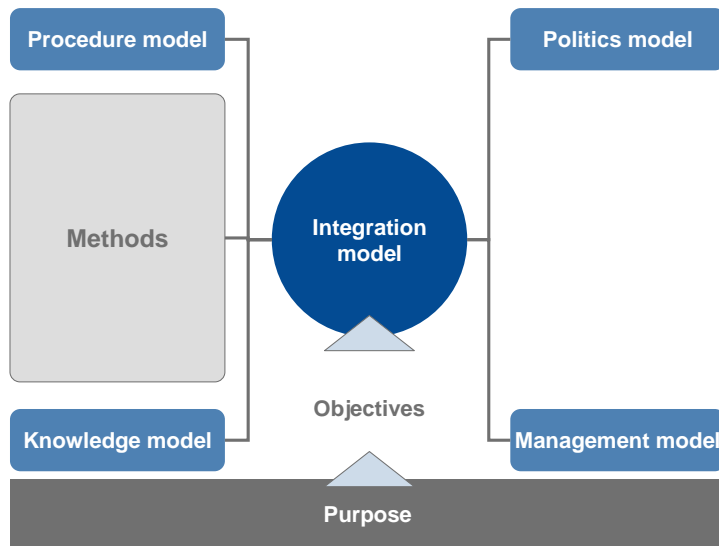


Figure 1. Dimensions of futures studies projects. Source: Author

While BOS is pragmatic by necessity, every part of it has a solid ground in established methodologies and science. The main ingredients – so to speak – of BOS are approaches from futures studies, especially multi perspective methodologies (e.g. Linstone’s (2002) technical, organisational, and personal (TOP) perspectives), systems thinking (cf. Gharjedaghi. 2004.). The very foundation of the framework is an understanding of futures studies “as an ‘action science’ dealing with ‘images of the future’” (Voros 2007) where accomplishment takes precedence over knowledge, similar to engineering, many of the social, and the medical sciences (cf. König 2006:85).

Table 1. Description of the futures studies framework’s elements. Source: Author

Element	Description
Purpose	Why the study is being made, the expected contribution, including the stakeholder’s (especially sponsor’s) expectations.
Objectives	What the expected outcome of the study and the deliverables are.
Integration model	The mode of operation ‘next level up’. A model that integrates all of the other elements. In Futures Studies the integration model typically is systems thinking or action research rather than empiricism.
Procedure model	Process-steps, how the time for the study is structured.
Knowledge model	How structuring and ordering of knowledge happens, the ontology at work.
Methods	Methods are sequenced by the procedure model and create knowledge into the knowledge model. They are the bridge between content and doing in the study.
Management model	How the project itself is managed, progress is traced etc. e.g. by “classical” Project Management or more modern methods like SCRUM.
Politics model	How power is being handled in the project. Most important: Is the project designed to fit in existing structures or to challenge them?

Most important, BOS does not touch the established management model (project management) and politics model (Stage-Gate). It is compatible with existing corporate structures.

The procedure model chosen is the generic foresight process framework (GFPPF) by Voros (2003) with its emphasis on interpretation was selected as the underlying approach and topmost procedure model for the BOS framework.

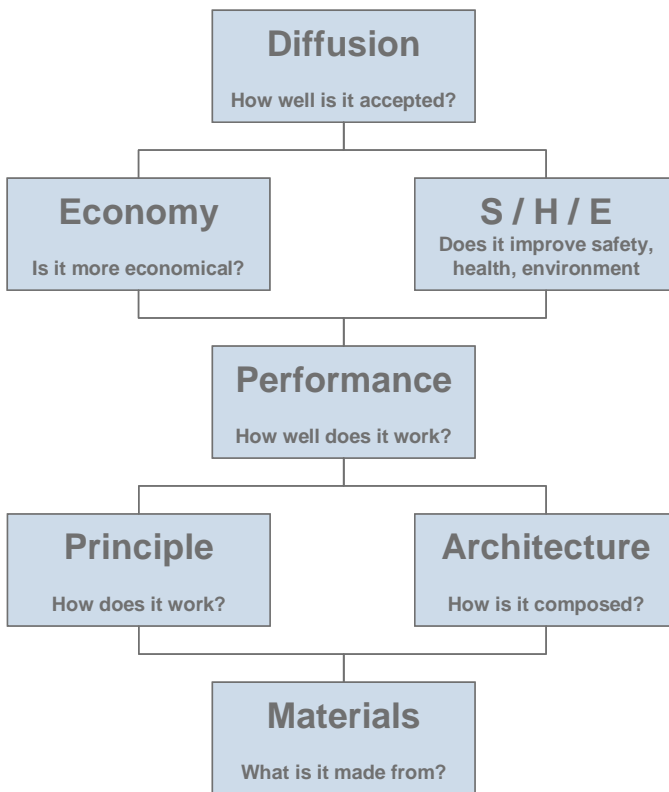


Figure 2. Cascade model of technology. Source: van Wyk 2004 with modifications by the Author

As the meta-model for knowledge organisation in the research part, the cascade model of technology by van Wyk (2004:39-41) provides an integral framework spanning the whole range of the socio-technical system, from materials and technical details to the society as a whole. (Fig. 2). For the BOS framework, this span is divided into the two “systems perspectives”: the business system and the technology system with the innovation to be designed at the intersection of these systems. The technology and business systems are influenced by the two “segmentation perspectives”: application and region (Fig. 3). The segmentation perspectives provide for an adequate scoping of the systems perspectives. Clearly, business in Europe is different from business in Japan (or in Arabia or wherever else), so the model of the business system has to be adapted to the region. On the other hand, the application, what the product is being used for, has also a large influence on the business system as different industries have established different procedures and have different needs. All study of these four perspectives is embedded in the study of the contextual environment with the long-term societal, technical, economical, environmental, and political changes.

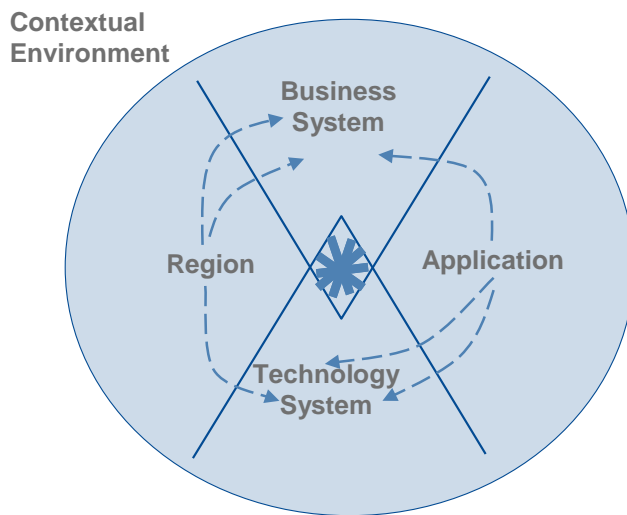


Figure 3. Sketch of the four perspectives of BOS. Source: Author

The analysis is performed as desk-research, until a certain level of understanding is available, then interviews with representatives from the relevant roles in the business system add a further level of detail and understanding. The interviews are semi-structured with the four BOS-perspectives plus the context as a guideline for enquiry.

Two system-models are created for the business system. A structural model, showing the organisation and timing of a typical project in the targeted business system. A project is defined as the sequence of steps (e.g. Consult, Plan, Build, Operate, Service) involved in the creation of the final technical system (plant, building, ...) in which the innovation will be incorporated. This is at least “one level up” from the innovation i.e. the containing system. The structural model also incorporates all the roles (e.g. Consultant, Owner, Finance, Planner, Manufacturers of components, &c.) involved in creating this final technical system, how they work together, when they enter and leave the project, their scope and responsibilities, and their decision criteria (when is an innovation a ‘good’ innovation). The MACTOR method (Godet 2006:245-279) is used for creating the detailed actor model.

The conclusions from the MACTOR analysis allow valuable insights into the structure of the business system, which routes are feasible for entering the business, which actors are in favour or opposed of the innovation, what the prerequisites for diffusion of the innovation are, &c.

Technology is viewed as a system subject to combinatorial evolution and structural deepening. (Arthur 2009) Relevance trees (The Futures Group 2003) structure the study of the technology system. The potential innovations are most likely embedded in further “onion skins of technology” with their corresponding compatibility requirements. Therefore, new as well as the currently available technologies are considered in depth. This often includes a detailed analysis of patent activities and research.

The technology analysis considers also (functional) substitutes from technological super-systems or sub-systems. The maturity, feasibility and potential acceptance across the business system is assessed for every relevant technology.

The final step of analysis is the creation of scenarios from the knowledge acquired on the technological and business system perspectives. The time-horizon takes into account the relevant technical substitutions, length of technology life-cycles (up to 60 years in the corporate context of KSB),

ongoing or expected changes in the business system, and the time required for the creation of an innovation by the firm itself.

The findings of diffusion research (Rogers 2003) provide a bridge between the insight gathered and the design of an innovation. Rogers (2003:15-16) gives a list of attributes of an innovation that allow to check ideas for business opportunities against the preferences and objectives of the relevant roles in the business system. This allows for a multidimensional and multi-actor analysis of success potentials and acceptance criteria within the business system for each possible innovation.

An iterative learning loop (Fig. 4) was chosen as the integration model for the innovation-design part, to facilitate the design of innovations that fit with the business system, anticipated technological developments and the enterprise. This learning loop, together with the richness of social analysis preceding it, enables to reconcile “people, profit, and planet”-the three pillars of sustainability in a unique way by designing suitable and acceptable innovations. The “one idea - one project - one product” paradigm at the basis of the process models for product development discussed above is abandoned in favour of learning and creativity. This creates a new paradigm for innovation processes; not “drowning the puppy” when an idea turns out inferior but first trying to elicit the full potential from it. Therefore, over the process of BOS, a business opportunity is changing and changed as further knowledge is acquired and more criteria for success become uncovered. It matures from idea to concept; gets merged with or spawns other ideas.

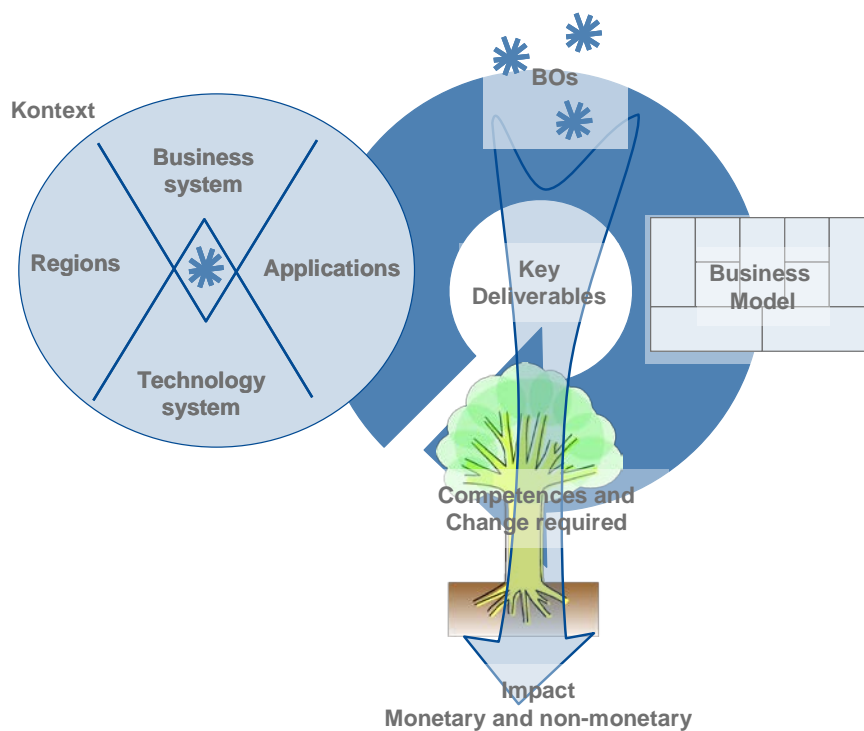


Figure 4. Interaction of analysis and design in the BOS framework. Source: Author.

The link between the company and the business system is the business model (See Osterwalder & Pigneur 2010; Osterwalder 2004 and Stähler 2002 for an extensive discussion of this concept). It describes how the company participates actively in its business system. At this point, the perspective of the study changes from passive (scientifically informed) gathering of knowledge about the business system to designing an active role for the company. The business model therefore is an object of design

also. It is expected to answer the question: How do we establish our company's contribution in the business system, where (in which role), and how is the company able to economically sustain the new business?

The competence tree (Godet, 2006:118-120) is used as a compact map of the current competencies, capabilities, and value propositions of the company. It allows determining the degree of change required by each of the business opportunities under consideration.

The design process iterates, over the potential business opportunities recognised studying the four perspectives, especially the business system, and tries which business models are possible for the enterprise, given the current competence tree and the enterprise's potentials for developing its competencies and capabilities. A first estimate of the economic potential is performed also.

The flow of evaluation considers the business opportunity, competencies and impacts (monetary and non-monetary) on the enterprise. Typical questions are: Can the enterprise make a sustained profit out of the business opportunity? How much does this profit require the company to change? Is the change required justified by the potentials for learning and earning? Does the business opportunity fit with the anticipated changes in technology, business, and contextual environment?

The most relevant outcome of a BOS is the key-deliverables for the innovation project to follow. These key-deliverables typically fall into three groups: Technical key-deliverables (the technical part of the innovation - the 'product'); company-internal key deliverables (e.g. modifications to business processes or the ERP-system); and diffusion relevant non-technical key deliverables.

In one project, a key-deliverable of the latter category was to give a blueprint for a system using a new component away for free to help the system integrators adopt the new technology. Another project instituted a project-council with relevant stakeholders identified in the MACTOR analysis as a sounding board to help continuously checking the progress in the innovation project against the relevant expectations of these groups.

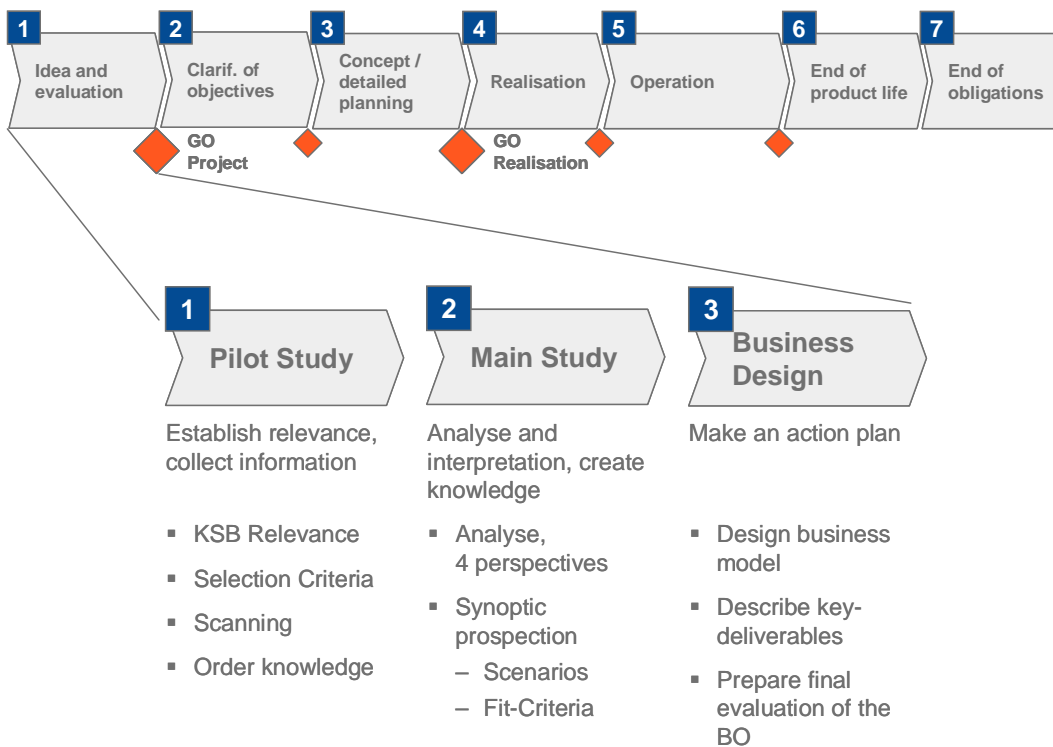


Figure 5. Integration of the BOS-Framework with the Product Lifecycle Process. Source: Author.

Figure 5 shows, the process reduced to a linear progression, confirming with management expectations and to enable the integration into the corporate product lifecycle process.

8. Case study

For confidentiality reasons, the case study has to be restricted to a single instance of an innovation that is currently undergoing the field tests. The River-Turbine (KSB 2010) represents a new category of hydropower installations without transverse structures blocking the migration paths of aquatic species. A further positive side effect is that the flow velocities of straightened rivers are reduced. Figure 6 shows one prototype while being installed.

It is the only kind of hydroelectric power station that improves the environment and fulfils the requirements by the European Water Framework Directive. The prototypes were installed near the town of St. Goar on the river Rhine in the UNESCO world heritage of the middle Rhine valley; a region that also has the highest possible protection for a nature reserve as a Habitat Protection Area where any other hydropower plant is virtually unthinkable. The River-Turbine coexists with other uses of the river, namely as a waterway and is hardly visible from above the waterline. It emerges from the core-competencies of the company, especially hydraulic design and structural mechanics but, on the other hand, requires a deliberate creation of a new business model in a not yet established business system.



*Figure 6. The River-Turbine prototype during installation. Source: KSB 2010.
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Further, according to KSB (2010) there is a market for ‘small hydropower’ internationally, for example in China, India or Russia, where the problem of supplying rural areas with electricity calls for creative solutions.

9. Conclusion

This paper demonstrates that corporations do not have to wait for sustainable innovations to happen (and sort out all other possible innovations in a funnelled process). The basic idea behind the framework outlined is, that in order to do so, the process as to consider “one level up” from designing an innovative product i.e. designing an innovation according to a wider set of criteria than the techno-economic ones used predominantly today.

The case study shows an instance of a sustainable innovation achieved with this novel Framework for the front-end of innovation that allows reconciling the different notions of sustainability by designing an innovation. This framework currently exists in a small pocket within a global organisation of 14.500 employees that targets the creation of highly innovative and future oriented projects.

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SUSTAINABILITY AWARENESS IN DESIGN - BRIDGING THE GAP BETWEEN DESIGN RESEARCH AND PRACTICE

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ABSTRACT – *This paper reports on the preliminary findings of a study on how design practitioners in Finland understand sustainability and implement sustainability principles. Our future aim is to employ this Barometer in determining how to best promote more sustainable innovation-oriented, design-centred practice in Finnish industry. Our hypothesis is that there is a crucial gap between academic research and professional practice in implementing design-for-sustainability. Moreover in our previous research we detected a gap between how human-centred designers (HCD) (implicating social sustainability principles) and eco-designers (implicating environmental sustainability principles) perceive their scope of responsibility. Initial findings from our survey indicate that this gap is possibly less significant than designers' capability to address the interface between the user and the ecosystem as well as the user and the wider social tissue. In fact, a greater difference seems to exist between product ("material") and service ("immaterial") designers in their prioritization: their perceived scope of responsibility (jurisdiction) and definition of design value. Our guiding framework is the Framework for Strategic Sustainable Development FSSD.*

1. Introduction

The objective of this paper is to describe the current status of sustainable design practice in Finland, according to our ongoing Sustainable Design Barometer project. We describe the background and motivation behind the project, our hypotheses, the logic behind the design of the Barometer, and some initial findings.

The core of the Sustainable Design Barometer Project is an extensive survey, the goal of which is to create a reliable tool for profiling designers and design competences in terms of responsibility, definition of success, sustainability, idealism and other attitudes or worldviews. Our standpoint is that in order to drive the development and implementation of sustainable solutions and eco-innovation, design practitioners need robust understanding and acceptance of sustainability principles and competence in future-oriented systems thinking. A carefully designed Barometer can detect where the gaps lie in both knowledge/knowhow and attitude/mindset between designing for the (unsustainable) status quo and designing for a sustainable society. Only by mapping the current status and the gaps can we robustly

address them in order to effect the radical change needed in post-industrial consumption and production patterns. In essence, we argue that this transformation in Finnish design will provide a more economically sustainable foundation for both the profession and Finnish industry generally.

As the study is ongoing, this paper will focus on chosen aspects of design value and design jurisdiction in Finnish professional design practice, from the perspective of the designers themselves. This is intended to reveal actual mindsets in the industry, and we compare them to 'ideal' objectives as delineated in literature and international indicators such as design competitions. Moreover, we suggest that the design educational and research context is better able to accommodate systemic perspectives and wider scopes of responsibility than the professional practice of design, whose business foundation is much more limited in timescale and how return (and therefore value) is defined.

2. Background

In this section we define necessary concepts, summarize our professional field and how it is changing, and indicate the framework within which we work. The scope of 'professional designer' in our survey is a practitioner working in a design agency or in-house design department, which implies that activities are not restricted to product or industrial design but encompass strategic design, service design, and tasks that extend to graphic design and architecture/interior design.¹

On Design

Valtonen (2007) published a valuable historical review of the Finnish industrial design profession, which illustrates how the focus of designers has expanded from form and aesthetics to driving company strategy and innovation. (See Figure 1, left) On the other hand another study for the Finnish Ministry of Employment and the Economy found that design practice in Finland has not evolved to its full "transformational" potential and remains centred upon product and service development alone, to the possible detriment of innovation and enabling well-being solution development (Aminoff et al. 2010). (See Figure 1, right)

¹ The fields of graphic design and architecture/interior design were not, however, directly targeted in this study.

	Typical statement on design	The design process	Typical role for designer
2000s Innovation & competitiveness	"Global competition and renewal" "China phenomenon"	Vision	Design as innovation driver
1990s Brand building	"Total experience design – from concept to retail"	Strategy	Design for creating experiences for customers
1980s Design management	"Our product portfolio is consistent"	Roadmaps	Design as coordinator
1970s The rise of ergonomics	"The user (be it a child or elderly) is the most important"	Product definition	Design for user understanding
1960s Involving industry	"Design as part of the industrial product development process"	The entire product development process	Design as part of a team together with mechanics and marketing
1950s Promoting the nation	"We got a prize in Milan"	Product aesthetics, styling	Designer as a creator

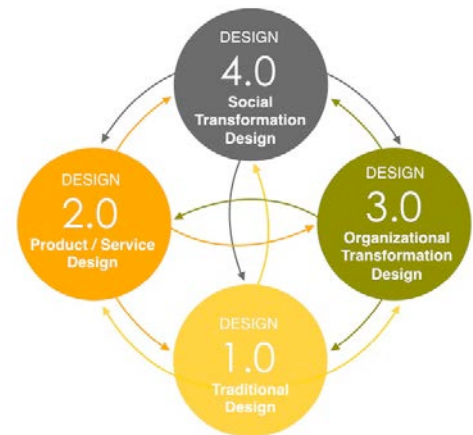


Figure 1. Left: The various roles of the designer and representative statements on design. (Source: Valtonen 2007). Right: The landscape of design practice and design education. (Source: NextDesign Leadership Institute, GK VanPatter and Elizabeth Pastor)

Design as a profession as well as an activity is therefore becoming increasingly valued throughout the business value chain and is no longer found at the end of the product/service development process in terms of mere styling or branding. The expression ‘design thinking’, for instance, is currently popular in the business press (see especially Brown 2009). Design thinking refers to characteristics of the design process that designers learn in their training, practices and approaches that can be adopted also by non-designers in innovation processes in order to strengthen creativity and solution refinement: brainstorming and ideation, reiteration and prototyping, and abductive reasoning combined with an empathic mindset. The European SEE (Sharing Experience Europe) project in fact regards design thinking as integral to promotion of sustainable behaviour (Whicher et al. 2010, 6). (See Figure 2.)

DESIGN THINKING MATRIX			
CORE STRENGTHS	creative	user-centred	viable
PROCESS	- synthesizes complex problem-solving (visualization)	- engages stakeholders (co-design)	- systemic
SOLUTION	- innovative (sometimes unexpected)	- desirable - inclusive	- fit for purpose - sustainable

Figure 2. Design Thinking Matrix. (Source: Whicher et al. 2010, 6)

The term ‘user-centred’ as seen in the matrix above is important and also needs defining. This indicates the change in design process from being product-, technology-, or sales driven to being human needs driven: from imagining users’ behaviour and desires to actually designing with them.¹

We will discuss design thinking, co-design and co-creation further in the Design Value section. The concepts are relevant to our study in terms of the involvement of more actors and stakeholders in the design process and the opportunities and threats this presents to the identity of the professional designer and how she may thereby define her own jurisdiction. Approaching these concepts through the lens of the FSSD also reveals the differences between product/material-oriented and product-service system-oriented designers.

On Design for Sustainability

The field of ‘eco-design’ began to develop several decades ago in response to the acknowledgement of design and production’s environmental impact. Eco-design, or Design for the Environment, refers to “strategies that aim to integrate environmental considerations into product and development” (Charter & Tischner 2001, 121). Specific eco-design tools and methods aid designers in considering the product’s entire life cycle, from material choices to clean manufacturing to disposal. Sustainable product design takes socio-ethical sustainability also into consideration (Charter & Tischner 2001, 121), while Design for Sustainability (DfS) strives to analyse whole systems of production and consumption and is therefore no

¹ For a clarification on the history and definitions of user-centred design, participatory design, co-design and co-creation, please see Sanders & Stappers 2008. To simplify this discourse, we will use the term ‘user-centred design’ (and ‘human-centred design’) referring to a process that includes participatory, co-creative activities with end-users in order to better identify and meet their needs, where, therefore, a product is not the starting point.

longer product centred. It is widely recognized, however, that the very concepts of sustainability and the sustainable development DfS attempts to promote are fuzzy and ill defined.

On Design for a Sustainable Society

Because of this fuzziness, and because we have witnessed the complexity of environmental problem-solving and the number of constant trade-offs that emerge when prioritizing, we have chosen an umbrella framework developed by The Natural Step to guide our work. The Framework for Strategic Sustainable Development (FSSD) provides a principled definition of sustainability, which serves to clarify and strategize fuzzy, fragmented intentions (see e.g. Robèrt et al, 2002; Robèrt 2009). Based on the framework's five levels, four sustainability principles and *Backcasting from sustainability principles* strategy process, we can better envision how design and designers can and should operate within a sustainable society: not only what the sustainable society should look like, but how we can achieve it. The FSSD has therefore been central in developing the Barometer's survey framework, as we explain further below.

3. Expanding our notion of design

To summarize the discussion thus far, the practice, profession, and competence of design is generally recognized as valuable to innovation processes and strategic regional competitiveness, and some – while not all – projects, studies and organizations expand this to include innovation that is also environmentally and socio-ethically sustainable. This suggests that the role of design is evolving naturally as driven by business needs, but it also suggests that we as professionals need to further expand the scope of design driven by ecological and societal needs if markets alone are not suffice.

To clarify what is push and what is pull in the design industry, it is helpful to examine two institutional practices in particular. Both the history and evolution of design competitions and the development of national design policies¹ illustrate the changing role of design, as they show both what exactly is valued in designed products and services as well as what aspects are deemed worthy of reward and promotion in the larger context. In this section we will therefore describe how the concept of value in design and the perceived jurisdiction of the designer are expanding, based on a literature review and our own analysis. This knowledge fed the design of the Barometer survey framework, as we wished to discover if and how deeply design practitioners have internalized these ideas and embedded them into their professional practice, identity and personal worldview.

Design Value

How the design industry and designers themselves define success in their work as well as how customers, users and stakeholders define the success of the end results of design constitute design value.

¹ This paper will not examine national design policies. (For an overview, see e.g. Sorvali & Nieminen 2008.) However, it is important to note that design policies encompass entire design processes, while design competitions tend to focus only on the end, most visible, result.

The assessment criteria used in the Australian International Design Awards,¹ for instance, exemplify well how “good design” in

- a) traditional design denotes form, function, quality and safety criteria,
- b) design management promotes innovation and strategy, and
- c) sustainable design stresses environmental criteria as well as user need.

For a Finnish example, the Fennia Design Prize evaluates entrants on the basis of

- a) business aspects, or the “ways in which the product promotes the business operations of the manufacturer or user”;
- b) usability, or the “suitability of the product to its function, users and operating environment”; and
- c) responsibility, or the “product responsibility with regard to society and the environment”.²

We therefore conclude that the meaning of “good design” is expanding from tasteful and functional physical characteristics to the meaning of good as responsible and ethical. This is a process that is recent and ongoing: the Australian International Design Awards introduced Sustainability into their general assessment criteria only eight years ago (Pemberton 2011), while the term ‘environmental friendliness’ is mentioned among Fennia Design Prize criteria only from 2005 and ‘responsibility’ from 2007. Figure 3 illustrates the expanding notion of design value as we see it.

We therefore suggest additional criteria to assess the value of design: from meeting a particular user’s or user group’s needs to meeting the needs of a community; from product safety to planetary environmental protection and even regeneration; from short-term profit and market share to long-term economic sustainability and sustained eco-effective innovation processes. We will explain the notions of design value and success further from the perspective of our survey in the next section. (See Figure 4.)

Design Jurisdiction

In our previous research on sustainable consumption and LOHAS marketing, we found that consumers’ buying behaviour largely depends on their perceived scope of responsibility (Kohtala 2011; see also Finisterra do Paço et al. 2009). A consumer with a narrow sense of personal responsibility that extends only to herself, her family and closest circle does not feel that her actions have consequences. In contrast, the consumer who recognizes that her actions have impact feels a wider sense of responsibility to her community and the environment, and this attitude is reflected in the products she purchases. We argue that this same value—attitude—behaviour hierarchy can be applied in the workplace and to designers’ decision-making at work. We have therefore designed our survey to also probe the notion of design responsibility, or jurisdiction.

In the previous sections, we have seen how the scope of responsibility of design has expanded from form-giving and functional considerations to building brands, steering strategies, and driving innovation. In Design 4.0 design is also employed to strengthen regional and national competence (or ‘brand’), to improve the usability of public services and infrastructure, and is increasingly liable for the entire product/service life cycle over a longer period of time. In a sustainable society, designers also have

1 See http://www.designawards.com.au/assessment_criteria.jsp .

2 Quotations taken from Fennia Prize website: <http://www.fenniaprize.fi/participation/program>

the competence to help develop dematerialization strategies for the benefit of society and the entire ecosystem without sacrificing quality of life.

Finally, as the nature of design practices shifts towards co-design and co-creation; as design agency is increasingly available to non-designers; and as social innovation continues to increase in scope and relevance, the traditional jurisdiction of design as a profession is called into question. Value is no longer evaluated in chains but in networks, and defining design value is also a question of deciding upon one's jurisdiction. Figure 3 illustrates our perspective on expanding design jurisdiction.

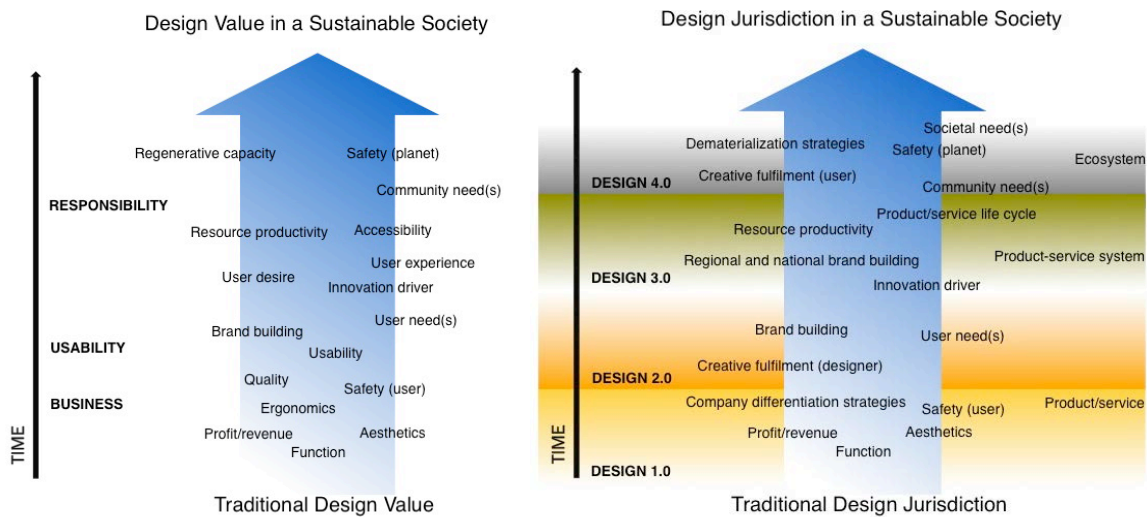


Figure 3. Design Value and Design Jurisdiction.

4. Survey

The Framework for Strategic Sustainable Development

As emphasized earlier, we base our work on the FSSD, which we have used to guide the principles and hypotheses underlying our survey and the Sustainable Design Barometer project. According to the FSSD, all complex systems can be divided into five levels: System, Success, Strategy, Actions and Tools. For planning in systems as complex as the ecosystem, a traditional definition of success is not sufficient: we must define our aims and goals in a principled way.

In essence, for successful design within the ecosystem and society, we need a principled definition of a sustainable society. This definition must be *science-based*, *necessary* for sustainability, *sufficient* for sustainability, *general*, *concrete* and preferably *distinct* (Robèrt et al, 2002). The framework's four system conditions, i.e. sustainability principles, have therefore been defined and developed according to a widely accepted scientific consensus, and they represent the only limits a designer needs to consider in her work:

In a sustainable society, nature is not subject to

- (SP1) systematically increasing concentrations of substances extracted from the earth's crust.
- (SP2) systematically increasing concentrations of substances produced by society.
- (SP3) systematically increasing degradation by physical means.

And in a sustainable society,

(SP4) people are not subject to conditions that systematically undermine their capacity to meet their needs. (e.g. Robèrt et al, 2002; Robèrt 2009)

The first three principles thus refer to environmental sustainability, the fourth to socio-ethical sustainability, and economic sustainability underlies the process of backcasting from these principles, within each step towards a sustainable society. A design team, community, or organization can then put these principles to work in practice, by forming a vision of its role in a sustainable society, backcasting from this vision, and systematically and strategically planning actions and making decisions to realize the vision.¹

Survey Framework

The survey framework thus probes designers' attitudes and actions regarding environmental sustainability (SP1-3) and social sustainability (SP4). Social sustainability in the FSSD refers to Max-Neef's work on and definition of fundamental human needs (Max-Neef 1991). We used this definition in the analysis of user needs as well as the designer's personal needs, such as the need for self-expression, creativity, participation and need of subsistence. Compared to the more common definition of human needs, Maslow's five-level hierarchy, Max-Neef's conceptual framework provides us with a wider perspective on users' needs in the context of creativity, thus encompassing the trends in design practice towards co-creation as well as non-designers who design. It also allows us to evaluate the various need scales of the designer's personal needs compared to the user's needs as well as societal needs. In addition, Max-Neef's framework makes an important distinction between societal satisfiers and pseudo-satisfiers, where, for instance, fashion fads and status symbols are pseudo-satisfiers, as they stimulate a false sense of satisfying the need for identity (Max-Neef 1991). How designers embed these aspects in their work is taken into account in our survey framework (Ugas, 2011).

In summary, in the survey framework we assume that design is target-oriented action towards some goal, conscious and/or unconscious. In the first phase of the Design Barometer project we focus on the dimensions of this goal, not specifically the definition of the goal itself. By locating this goal we intend to reveal something about the future and aims of the design profession and what kind of world these professionals are building for society. As opposed to analysing the history and current status of design (as indicated in our earlier discussion and literature review), in the survey we focus on the progress and changes within the design profession as seen by the designer herself. The survey framework is laid out in Figure 4 below.

¹ This process is called The Natural Step ABCD Process. (See <http://www.naturalstep.org/en/abcd-process>)

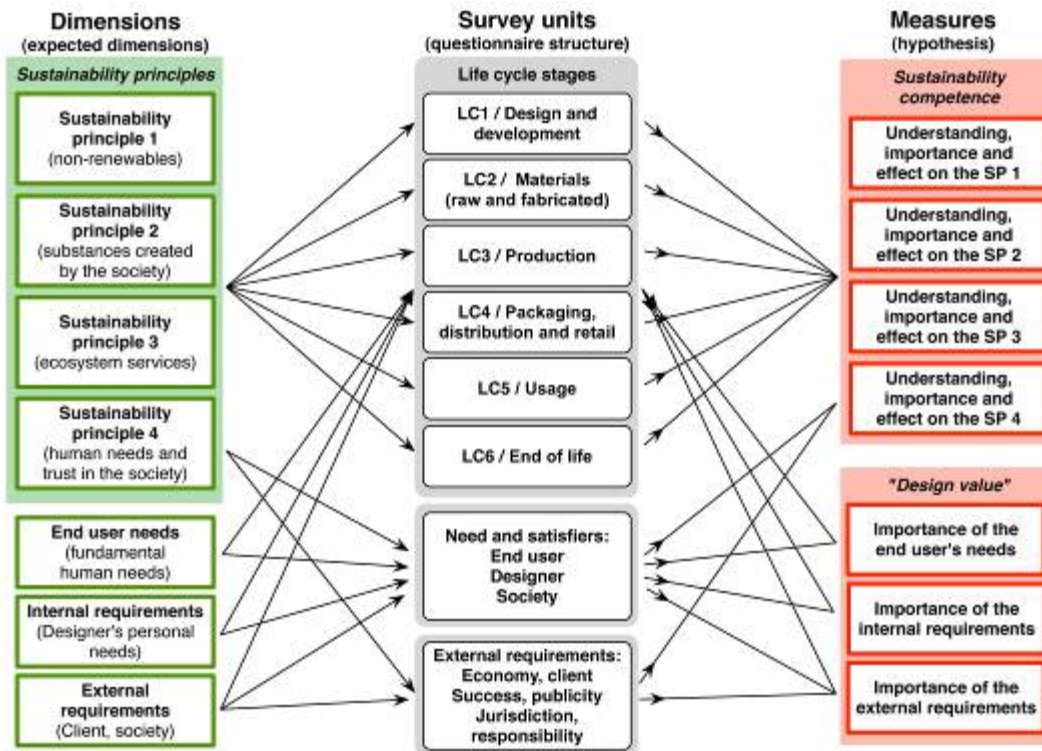


Figure 4. Survey framework: Dimensions, survey units and expected measures

5. Survey results

The survey link was delivered directly to designers in Finnish design agencies, as well as freelancers and a selection of in-house designers.¹ For the preliminary analysis we took a selection of designers that are either oriented to industrial/product design (N=13) or service/strategic design (N=9). The analysis concentrates on the differences between these two groups, in order to reveal the potential effects and emerging issues of the product-service system approach in Design for Sustainability.

Selected survey questions and results

1 Designer's competence/capability in responsibility issues

In general the respondents felt they are slightly more competent and capable of more responsibility compared to their team or community, and they are comfortable with their own competence level. The control questions confirm that this self-evaluation is mainly correct. Comparing this self-evaluation with how the designers pay attention to various user needs questions our hypothesis about the gap between eco-designers and user-centred designers: the industrial designers' competence in addressing user needs does not seem to have a (positive or negative) correlation with the level of understanding the links in the value chain.

¹ A total of 124 invitations to complete the survey were sent by email and direct messages in Facebook. As the questionnaire was rather long and detailed, only 56% who began completed to the end, which gave us detailed and high-quality material on 26 designers.

2. Designers and ethics

Most of the designers responded that during recent years they have never (55%) or rarely (26%) had to make decisions that run against their personal ethics. Almost every second (45%) respondent had at least once said 'no' to a project because of ethical or ecological reasons. However one-third had at least once taken on a project for economic reasons, even though they felt the brief went against their professional or personal ethics.

3. Paying attention to the value chain

There is a significant difference between the product/industry-oriented and service/system-oriented designers in paying attention to certain phases of the value chain: service/strategic designers pay much less attention to materials and production (see Figure 5).

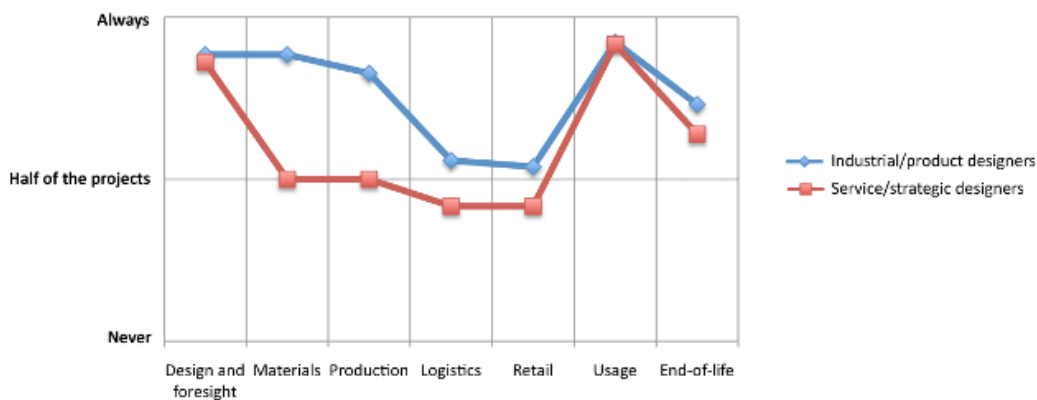


Figure 5. "During the last 12 months, in your projects, how much attention did you pay to the various links in the value chain?"

4. How the designers consider the user's fundamental needs

Analysis of the averages and standard deviations of the product/industry-oriented and service/strategy-oriented designers show that the only significant difference between them lay in understanding and considering the end user's need for participation. Service designers tend to place higher trust in the user when it comes to defining what is good design and what is responsible in design. However, all the designers seem to recognize fairly well the real needs and true satisfiers from the pseudo-satisfiers and fake needs.

6. Conclusions

The preliminary analysis of the survey results is leading us to the conclusion that the commonly acknowledged strengths of the design profession, such as considering various user needs, functionality and understanding of materials and production are also the actual characteristics in practice of the design profession of our decade. We are willing to consider this a signal of the reliability of the barometer framework.

The gap between eco-designers and user-oriented designers is not as evident as we hypothesized (design-for-the-environment and design-for-the-user), but there seems to be a gap between a sense of global responsibility and the focus on the user. As mainstream design moves towards the design of product-service systems, we could suggest that this more systemic perspective will also help bridge the

gap. In our survey, the lack of consideration of ethical production and little or no emphasis on ethical issues in design briefs is cause for concern in this regard.

However, if we move to PSS models in business, our survey results point to the potential danger that we will lose sight of products and production. For example, the service designers in our survey focused noticeably less on materials and production than product designers, and both groups rarely consider logistics and distribution in their design processes.

In conclusion we see that the designer's perceived jurisdiction is smaller than it could be (or should be), meaning that designers prioritize a particular user or a user group over the wider society. We propose that this gap between user and global responsibility may be closing in future as today's design students graduate and move into design practice. This is supported by statements made by design professors we interviewed, such as: "Sustainable design is actually an extension of how we should understand good design and what should be included in good design, issues such as global responsibility, the sweatshop issues, etc. It's no longer what is between the product and the user and the immediate environment, but the whole global system."¹ Forging the strategic link between everyday business practice and addressing the macro needs of both the ecosystem and the society at large is a clear challenge, one that we will address in future phases of this project. The need to unpack the meaning of social sustainability and the layers of the social tissue in terms of user/community/society needs is especially relevant to our research.

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¹ Interview, Professor 1, 9 May 2011.

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SUSTAINABILITY AND INDUSTRIAL DESIGN IN FINLAND: BARRIERS AND FUTURE PROSPECTS

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ABSTRACT – Considerations of environmental and social responsibility have been present within the field of industrial design in Finland ever since the 1960's. However, despite an early encounter with sustainability issues the learning curve towards sustainable design seems to have been longer than could have been expected. Based on literature and semi-structured interviews with design professionals, this paper highlights the barriers sustainability has faced within the field of industrial design in Finland. It is shown, that contextual factors have had a strong influence in the development and institutionalization of new practices and ideas. Due to this sensitivity to context, future prospects for sustainable design are discussed based on three scenarios that explore the future of sustainability. As a result, the article identifies key issues that shape the development and future of sustainable design.

1. Introduction

Industrial design is “the professional service of creating and developing concepts and specifications that optimize the function, value and appearance of products and systems for the mutual benefit of both user and manufacturer” (Industrial Designers Society of America 2010). Although product design focusing on ergonomics and aesthetics has traditionally been – and still is – the main suggested focus area for industrial design, contemporary definitions and studies emphasize the strategic capabilities and importance of design as a driver of strategy and innovation (see eg. Valtonen 2007; Verganti 2009). The majority of Finnish industrial designers work in design agencies¹, “selling their services as consultancies to enterprises using design” (Valtonen 2007, 170-172). Whether working in an agency or as an in-house designer, designers often work within product development groups along with experts from various fields such as engineering and marketing, acting as mediators and synthesizers of knowledge and data (Lehtinen 1995, 46; Industrial Designers Society of America 2010).

The formal education of industrial design in Finland began in 1961 (Valtonen 2007, 68). During the same time, concerns for the social and environmental impacts of design were under a lot of discussion. Probably the most prominent advocate of more responsible design practices was an American industrial designer Victor Papanek, whose claims about the negative impact of industrial design helped lay the

¹ The alternative to designers working in agencies is in-house designers who are employed directly by companies.

foundation for what is nowadays called sustainable design¹. Papanek's famous claim that "there are professions more harmful than industrial design, but only a few of them" (Papanek 1985/1971, ix) did not go unheard of in Finland and although his seminal book "Design for the Real World: Human Ecology and Social Change" was not published until 1971, Papanek was highly influential in the Finnish design scene already in the 1960's through a number of events and seminars (Yleisradio 1969). Today, Papanek's claim may sound exaggerated and harsh, but it is not without justification as the majority of the sustainability impacts of products are 'locked-in' at the design stage (eg. designing a ship powered by sails vs. a ship powered by a combustion engine) (Lewis et al. 2001, 13).

However, despite this early encounter with sustainability, design has been very slow in adopting sustainable design methods and approaches. The rhetoric of design literature provides an excellent example of this: in a book on industrial design published in 1995, Lehtinen states that ecological considerations will be essential in product design *in the future* (Lehtinen 1995, 38). Moving along, sustainable design was still considered a new topic in the beginning of the 21st century with little integration to education (Charter & Tischner 2001, 17) and concepts such as life-cycle assessment and extended producer responsibility were referred to as "new millennium' tools [that] will revolutionize how business creates new products and services" (Lewis et al. 2001, 13). To round things up, in his aptly named book "Design is the Problem: The Future of Design Must Be Sustainable" from 2009, Shedroff states that in order for design to have a future it needs to be sustainable (Shedroff 2009, xxvii). Based on these insights it is evident that sustainability has been an up-and-coming topic in design for decades.

This kind of a long adoption curve would make sense if the profession of industrial design was particularly averse to new ideas and approaches but this has not been the case. Industrial designers have constantly been looking for ways to gain more influence in product development and acquired new tools and approaches from ergonomics to design management to usability. Additionally, industrial design has emphasized the scientific and rational character of its methods and approaches in order to differentiate itself from the arts and align itself better with the industry and market (Valtonen 2007, 103 & 306). Based on this, a hypothesis can be created that sustainable design has failed to meet these requirements of rationality and alignment with the industry and markets. Looking at a theory of institutionalization gives further grounding for this notion. Barley & Tolbert define institutions as "historical accretions of past practices and understandings that set conditions on action" and further state that contextual change is often required for actors to challenge and revise existing models of operation (Barley & Tolbert 1997, 99-102). What remains to be discovered then are the barriers and reasons why sustainability has not aligned industrial design better with its operational context, the markets and the industry.

In addition to identifying the barriers that sustainable design has encountered in the past, this paper looks forward through three scenarios that explore the future of sustainability. As alignment with the operational context of industrial design (ie. industry and market) seems to be a key factor in the development of the profession, changes in context will likely influence industrial design significantly. Thus, in order for sustainable design to become mainstream, it needs to conform to the operational context surrounding it. As de Geus argues, scenarios enable a wider perspective to be seen and create

¹ Sustainable design can be simply defined as being "concerned with balancing economic, environmental and social aspects in the creation of products and services" (Tischner & Charter 2001, 121). The focus of this article is mainly on eco-design, which focuses on environmental sustainability.

“memories of the future” that enhance sensitivity towards upcoming signals and challenges (de Geus 1999, 59). Through foresight and scenarios it is then possible to anticipate future changes in the context of industrial design and shape the agenda of sustainable design towards a future of wider acceptance and utilization.

This paper is divided into three parts. First, the barriers sustainable design has faced are explored through interviews conducted with design professionals on the topic of sustainability, supported by literature on the topic. Second, insights are drawn from three scenarios that focus on the topic of how sustainability will change and develop. Last, future prospects and requirements for the domain of sustainable design are discussed. Before moving along, one note on the scope of this paper: although the dimensions of environmental, social and economical sustainability are often presented as equal to each other, the environmental dimension often stands out as “more equal than the others”, forming a “precondition for the other dimensions” (Tukker 2008, 15). Also in this paper the main focus is on the environmental dimension of sustainability, due to its close linkage to the tradition of industrial design (ie. designers can fairly easily implement methods that eg. save material but have a lot less to say in what kind of work conditions the product is manufactured in).

2. Barriers to sustainable design

This section is based on eight semi-structured interviews¹ that were conducted between November 2008 and February 2009 with design professionals, supported by insights brought in from literature. Although the focus is on industrial design, the selection of interviewees was not strictly limited to designers with formal education in industrial design. Instead, designers that work in industrial settings or are influential in the context were chosen in order to achieve a slightly broader view on the matters at hand. Thus, the final sample consisted of six industrial designers, a ceramic designer working in an industrial company and an interior architect who has been highly influential in design education. Another important – but not decisive – selection criteria was a background in sustainable design, ie. the designer had visibly brought forward sustainability in his or her work previously. Two designers without an expressed preference towards sustainable design were also interviewed because of the insights they might offer to the problems that relate to sustainable design itself as an approach. As most Finnish designers work in design agencies and not as in-house designers in companies the sample is fairly descriptive of the overall field with six out of eight designers coming from an agency background. The ages of the interviewees ranged from about 30 to 65 years, featuring a good mix of veteran designers who have been around since the formalization of the industrial design profession as well as younger designers graduating in the 21st century. The interview theme was focused on sustainable design and especially on how it was practiced and reacted to in the context of the design practice.

All interviews were recorded, transcribed and analyzed utilizing the Barley & Tolbert framework of institutionalization (Barley & Tolbert 1997). According to the model, there are four phases in the institutionalization of new ideas and practices. In the first two phases actors encode and enact existing

¹ The interviews were originally used for the author’s Master of Art-thesis, of which this section is a re-iteration with a more limited focus

models of behaviour and institutional principles (“scripts”), often unintentionally. For example, in the context of industrial design a common script for a designer to enact would be to generate sketches and drawings early in the design process or to highlight the importance of the usability of a product. Of specific interest for this article are the last two phases, where members of the institution revise or replicate existing scripts and lastly externalize and objectify them. These are the phases in which the role of the context plays a crucial role and to a great extent determines whether existing behaviour is to be revised or replicated. This article suggests that focusing strongly on environmental sustainability is a revision of scripts because it differs from the often-agreed tasks and definitions of industrial design (ie. focus on aesthetics and ergonomics). In the interviews the focus was therefore on how the designers had attempted to revise existing scripts and in case of failure, what they experienced the reason of the failure to be. As the model also suggests, this phase of the process often requires intentional action to be effective. Therefore, the motivation and background for the intention to change existing scripts (ie. to engage in sustainable design) is also looked into. For example, whether sustainable design has been a part of professional education is a relevant question for understanding the capability to intentionally question existing and introduce new scripts.

Based on the analysis of data, three main barriers were identified. These are barriers imposed by 1) a lack of pull towards sustainability 2) problematic image of sustainability and 3) methodological issues relating to sustainable design. Next, I look into each of these barriers through the interview data and insights brought in from literature. Selected interview replies have been collected to Appendix 1 to elaborate the issues discussed with replies 1-3 referring to category 1, replies 4-6 to category 2, and 7-9 to category 3.

1) Lack of pull

The first identified barrier was a lack of pull towards sustainable design on many fronts and especially in the domain of environmentally sustainable design. To start with, none of the interviewees felt that education had taken a strong role in advancing sustainable design, although the topic had been introduced to many. The call for more sustainable design approaches was in many cases a student-led effort and as a veteran of design education puts it, “it was the students who were creating the change”, supported only by some individual members of the teaching staff. For two younger graduates sustainable design had become a topic of interest in the end of their studies through individual projects, but not extensively. Considering the model of institutionalization, these aspects are very interesting since the last phase generally suggests that patterns of action should be disassociated from specific actors and conditions in order to become institutionalized (Barley & Tolbert 1997, 102). Therefore, although being introduced as a topic, sustainable design was not something that would have cut through the whole of design education. As education is a key factor in shaping the professional practice of industrial design (Valtonen 2007, 102), the lack of education on the topic can be seen as a major barrier when considering the need for intentional action to change existing scripts.

Since companies approach design agencies to buy design services, the content of the contract and design brief plays a key role in determining whether or not sustainability plays a role in the product requirements or specifications. Based on the data, the results whether sustainability had been requested by clients were rather mixed: some considered sustainability to be rarely requested while others replied

that it is quite common for companies to have socio-ecological concerns in design briefs. For the two in-house interviewees the same applied with the other replying that sustainability cuts through the whole brand and operations while the other considered it to be almost nonexistent consideration. The interviews to a great deal confirmed the notion that in medium to large enterprises sustainability plays a more crucial role. However, what was common across the interviewees was a rather distinct scepticism towards sustainability-oriented projects in general. First, there was scepticism towards the capability to actually realize these sustainability-oriented projects. Second, the motives behind the request for sustainability considerations were sometimes seen only as a “communicative”, ie. leaning towards greenwashing. Third, in many cases the designers felt that the design briefs containing sustainability considerations were badly formulated, ie. the focus was on wrong things. This relates to the overall development of sustainable design, where the focus has shifted from products to more systemic and strategic considerations. However, the possibility to actually influence the systemic level and target strategic sustainability issues is often very limited: product design still is the most bought design service (Holopainen & Järvinen 2006, 17) and designers come involved in product development at a fairly late stage, when important sustainability-affecting decisions have already been made.

2) Problem of image

Problems with the image of sustainability and sustainable products are numerous and often discussed in literature. Whether relating to the costs of sustainability (Porter & van der Linde 1995), product preference of consumers (Luchs et al. 2010) or the stereotypical look and feel of sustainable products (Ritala 2002, 24-26), it is not given that sustainability is considered as an asset in design and product development. The problem of image also came up in the interviews. First, there was a problem related to sustainable products and how they are presented. The “communicative” form of sustainability that was already mentioned previously was considered also a liability in terms of image because it sets values and creates oppositions to products even if there is no valuation to be done (ie. lack of sustainability claims in some products creates an illusion of unsustainability that is not grounded on solid evidence and vice versa). Furthermore, the stereotypical, crusty and unfinished aesthetics and looks of eco-design evoked negative connotations related to greenwashing and a “recycling image”. According to Steffen the problem of green product image and aesthetics stems from the change of political atmosphere in the start of the 1980’s: technology was lifted to the forefront of environmental protection and the products that were seen as symbols of the rising green movement in the 1970’s became rejected as “clumsy, hillbilly, or muesli-like” (Steffen 2010, 95).

Another problem related to the image of sustainable design relates not so much to the produced artefacts but to the movement that sustainability is associated with. Many of the interviewees considered that sustainability and sustainable design had very strong ties to the hippie movement and political radicalism in the 1960’s and 1970’s and this created juxtaposition between design and the industry. The political turbulence of the 1970’s was very prominent in Finnish design education. Korvenmaa states that the communist, anti-capitalist and anti-elitist movement was particularly strong in the department of industrial design which was torn by political conflicts: on the other side, the government and some members of the design community were trying to align the profession better with the industry while the students did not want to serve the machinery of capitalist oppression and the elite (Korvenmaa 1999,

187-195). Many of the interviewees did consider that sustainable design still comes with an image of preaching and a danger of stigmatization, leading some of the designers to adopt a stealth approach to sustainable design, disguising it behind eg. ease of manufacturing or cost savings. Therefore, rather than actually questioning existing scripts, they have become interpreted from the perspective of sustainability (eg. saving material and saving costs).

3) Methodological issues

One of the most problematic barriers that came up relates to the approaches and methods of sustainable design, ie. guidelines and practical tools for how sustainability is actually achieved. As has been mentioned, industrial design has constantly emphasized its rational and scientific character in order to align itself better with the industry and markets and separate itself from the arts. This came through in the interviews very strongly, both explicitly and implicitly. The important point here is that while sustainable design can be practiced fairly easily through eg. avoiding toxic substances in manufacturing or creating energy savings, providing justification for these operations and communicating them is on rather shaky foundations. Some designers clearly stated that there should be methods to concretely and quantitatively verify design choices made on a sustainability basis and the others implicitly brought the calculability of choices as an important factor related to communicating and providing proof for sustainability. Especially the designers who did not have a visible track in sustainable design pointed at difficulties with the unpredictability of sustainable design methods. From this point of view, poor institutionalization of sustainable design makes a lot of sense. As Heiskanen has stated based on sociological studies, the institutionalization of leadership models rarely has to do with the quality or righteousness of the model itself but rather with its capability to reduce uncertainty in practice (Heiskanen 2000, 8). Therefore, even if sustainable design is seen as desired and necessary, the tools that support the process of sustainable design have not reached a state where they are trusted and on a fully scientific basis (ie. that they would provide comparable, repeatable and verifiable results) and moreover, be usable to designers.

The problems of eco-design methods become even more evident when they are compared to ergonomics, which became a widely utilized approach in design in the late 1960's. The success of ergonomics was specifically based on the possibility to rationalize and provide scientific basis for the design process and design decisions. As many of the older designers stated, ergonomics was "the best know-how to give design more value" at that time and it also became the driver of the success enjoyed in the 1980's. What is more, ergonomics offered a channel to acknowledge social sustainability issues in design, suggesting a similar stealth approach that was related to the problems with the image of sustainable design.

3. How will sustainability change: three scenarios

This section draws insights from three exploratory scenarios that were created for STX Europe as a part of FIMECC's¹ Innovation & Networks-program. The scenario details were targeted at the specific context of STX Europe but the as the basis of these scenarios was in the general developments of sustainability, the principal ideas in each scenario are usable here as well. The scenarios were created using future matrixes and the scenario filter model (see Leppimäki et al. 2003) as the main tools. The following contains a short introduction to each scenario. The weak signals or wild cards to each scenario are not discussed in detail due to the limited space available here and due to the scope of this paper.

Scenario 1: Sustainable Failure

The Sustainable Failure-scenario is a society-driven scenario in which sustainability fails to gather critical mass behind it and fails to become a top priority in the society. The scenario suggests that the debate on sustainability continues, dominated by selfish interests and no clear vision or agreement on what should be done, how or when. Progress in sustainability is slow, as the data on sustainability issues remains complex and hard to evaluate. Legislation is not very effective in improving sustainability, focusing on reactive measures. Consumers and the society value sustainability in theory, but it does not guide practical action. Other issues such as economical downturns easily overshadow sustainability as it has little meaning to most people.

Scenario 2: Clean Technology

Driven by technological change, the Clean Technology-scenario suggests that the fear and signs of climate change lead to a rapid development of clean technologies especially in the area of energy provision. Trust and belief in technology becomes very strong and in the wake of clean energy, technology becomes a driver of sustainability in many areas such as material technologies. Many see environmental sustainability as a solved issue as the threat of climate change is alleviated through clean energy provision. Legislation is very climate-focused, setting goals and giving relatively much responsibility for companies to find the best ways to meet these goals.

Scenario 3: Aware Consumers

In the market-driven Aware Consumers-scenario, business-as-usual actions have resulted in serious catastrophes, bringing sustainability problems to the footsteps of everyone. This has led to a change in consumer behaviour and attitudes: sustainability has become the main purchase and assessment criteria. Trust in corporations and companies as the drivers of sustainability is low and NGO's play a more important role. Moreover, boycott's and straight action is not uncommon and people are generally

¹ FIMECC (Finnish Metal Engineering Industry Competence Cluster) is a company that "works to boost strategic research in metals and engineering industries." (FIMECC 2011). For more information, see www.fimecc.com.

willing to act and take responsibility for the creation of a more sustainable world, shifting towards a more participatory model of democracy.

4. Conclusions

The three scenarios presented suggest rather varied trajectories when considering the future of sustainable design. Although none of the scenarios will likely realize as they are presented here, they do offer a good ground for action that can be taken today in order to shape and build the case for sustainable design. What are then the future requirements and prospects for sustainable design when considering the barriers it has faced in the past?

In case the lack of pull continues as presented in the Sustainable Failure-scenario and sustainability remains as a secondary concern, design should actively push sustainability in order to make it a mainstream issue. However, special concern here should be paid to how sustainable design is realized and communicated: if sustainability is not meaningful on its own, it should be translated to measures and terms more meaningful, eg. economic measures. A recent survey on the adoption of sustainability practices stated that building the business case for sustainability typically starts by picking the “low-hanging fruit” first, such as waste reductions and energy efficiency because they are easily tied to overall business efficiency and measurable in economic terms (Haanaes et al. 2011, 8). Communication plays a key role also in the more sustainable scenarios but on different levels. Due to major improvements in sustainable technologies, the Clean Technology-scenario might witness the introduction of a new barrier: complacency. Therefore, sustainable design should then be very sensitive to emerging sustainability issues and things that fall out of the radar of technology and help create a sense of urgency to act on emerging issues. Based on the situation of the Aware Consumers-scenario, focus should be paid to understanding and transparency of sustainability and its indicators. For example, consumer packaging has received excessive amounts of attention due to its visibility in the household waste stream (Lewis et al. 2001, 110) although it constitutes only to about 0,5% of the overall waste stream (at least in Finland) (Kautto et al. 2001, 45). Therefore, the role of communication here takes a more informative stance in order to avoid conflicts between consumer awareness and factual sustainability. In addition to these insights and regardless of whether sustainability is valued or not, design should actively put forward guiding visions in order to help “shape the intentionality behind material design” towards sustainability (Wahl & Baxter 2008, 83) and because of the capability of future visions to shape consumer expectations (Pantzar 2000, 3).

Although the problem with the image of sustainability seems to be shifting towards a better direction, the topic will likely need attention in the future as well. As the last stage in the model of institutionalization suggests, scripts should be disconnected not only from certain actors but also from certain historical conditions in order to achieve a normative, factual quality (Barley & Tolbert 1997, 102). Because of the heavily political history of sustainable design, at least in the Finnish context, effort should be put into breaking apart from particular political views or silos, especially in business-as-usual futures such as the Sustainable Failure-scenario suggests. Similarly, the aesthetical and communicative characteristics of sustainable design need to be revisited. The goal of the sustainable design community should ultimately be to make sustainable design mainstream and therefore also product qualities should match mainstream taste. Of course, one could argue that in an ideal situation mainstream taste should

be sensitive to sustainability as the Aware Consumers scenario suggests, but until this point is reached separating between the sustainable and the non-sustainable – whether from an ethical or aesthetical perspective – is not likely to push sustainability from niche to mainstream.

Last, whether sustainability becomes normative or not, design methodologies for addressing sustainability should be developed substantially. The interviews showed that the problem is not so much of how to design for sustainability but on how to assess, compare and justify some actions over others and communicate them in a meaningful way. This calls for the development of easy to use, robust analysis tools that are easily adapted to the design workflow. Especially if sustainability becomes a normative quality and contextual requirement, justifying actions has to be based on solid and transparent evidence. Moreover, the current methods for addressing sustainability focus mainly on decreasing the impacts of production (see eg. Lewis et al. 2001) and offer very little insight into how to engage consumers in sustainable consumption or make sustainability meaningful to them. Also, in scenarios where sustainability has advanced, whether through technological improvements or market pull, the shifts suggest a change in methodologies by making certain approaches obsolete (ie. if all energy is clean, is there a need to design appliances for low energy use?). Therefore, as suggested by Saritas & Aylen, foresight through scenarios and road-mapping should be used extensively in order to recognize to-be obsolescent approaches well in advance (Saritas & Aylen 2010, 1073).

5. Discussion

This article has identified barriers that have slowed down the adoption of sustainable design methods in industrial design practice and put forward key issues that need to be tackled in the future in order for sustainable design to gain wider appeal. However, the scope of this paper is rather limited, a lot of work in this area remains to be done. First of all, the focus of this article – Finnish design and environmental sustainability – is rather limited: some issues, such as the methodological problems are global in nature but whether the strong political stigma of sustainability is shared in other countries remains to be solved. Second, this article has looked at things from the perspective of design and while it gives reasonably good explanations for the witnessed barriers, more input from the context, ie. the industry and market on the same topic should be gathered in order to provide more robust solutions to the problems of institutionalization (for example, the lack of pull might just as well be a result of a perception that design is not capable of or willing to handle sustainability issues).

Despite these limitations, this paper does provide relevant questions to address in future research. One prominent area to look at is communication. As designers are often seen as synthesizers between various interests groups in product development, the importance of mediating information between different stakeholders and interest groups in a manner that is meaningful throughout the network of actors is and essential topic to explore.

Appendix 1

1. "Sustainability has always been my personal interest but if I think of my basic studies it was not on the agenda then in any way, the 80's was just fast forward..."
2. "In practice the development [of sustainability] has been left to the level of what legislation and EU-directives demand... Not many companies see it [sustainability] as a competitive benefit so that they would actually do more than what is required."
3. "It was very rare [that companies requested sustainability], sometimes we tried to push it forward. And I recall that we tried to avoid some bad plastics or whatever small things you were able to do."
4. "In the 60's the environmental was very close to the hippie movement and the environmental radicalism that followed gave it a very strong image of societal criticism and this surely caused problems with the industry."
5. "Sustainable design has been given this 'recycling-reputation'...Maybe in the initial stages its important to manifest it by doing things from used bottle caps but that makes it look unprofessional..."
6. "I believe that there's a lot of emotion brought in when you start speaking of sustainable development... A lot of old preconceptions of preaching."
7. "We should get that sort of tools that you could somehow evaluate manufacturing methods and where the product is made, so that you could physically somehow count things, you could get factual data."
8. "Quantitative methods work quite well especially when dealing with corporate management"
9. "Sustainability was present a lot during my studies as a topic... but that there would have been something genuinely knowledge-based and useful I don't recall."

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12. ADDITIONAL PAPERS

GOVERNANCE AND INSTITUTIONS FOR SUSTAINABLE AGRICULTURAL AND RURAL DEVELOPMENT IN BOSNIA & HERZEGOVINA

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ABSTRACT - Governance analysis focuses on institutions and structures dealing with decisions making and implementation. Governance influences agro-rural development policies impacts on rural livelihoods. Rural economy in Bosnia & Herzegovina (BiH) is increasingly diversified but is still strongly dependent on the primary sector.

The paper aims at identifying the main public and civil society institutions dealing with agro-rural development policies in Republika Srpska (RS) and BiH and at analyzing relationships and linkages between them and with international organizations. Recommendations have been made to improve coordination between involved institutions. Paper is based on primary information collected by questionnaires and semi-structured interviews carried in summer 2010 with representatives of public and civil institutions as well as an extended secondary data analysis. Vertical coordination between State level institutions with entities, cantons, regions, municipalities and non-state actors, especially civil society ones, is still particularly challenging in BiH. Coordination between the State Ministry of Foreign Trade; Ministries of Agriculture, Forestry and Water Management (MAFWM) of RS and Federation of BiH and the Department for AFWM of Brcko district is crucial. Participation of civil society organizations in rural development policies design and evaluation should be encouraged. Effectiveness of vertical coordination also depends on horizontal co-ordination at RS and FBiH levels.

Key words: Governance; rural development; Republika Srpska.

1. Introduction

Bosnia and Herzegovina (BiH) consists of two governing entities, namely the **Federation of Bosnia and Herzegovina (FBiH)** and **Republika Srpska (RS)**, with a third region, *i.e.* **Brčko District (BD)**, that is administered by both entities. It goes without saying that this institutional and political setting influences not only the design and implementation of agricultural and rural development policies but also the governance of the whole country.

Rural economy in BiH is increasingly diversified, however, a significant share of households is still engaged with agriculture, and the rural economy is still strongly dependent on the primary sector. The share of agriculture in Gross Domestic Product (GDP) was 8.40% in 2008. Agricultural land covers 50% of the total area of BiH. The average size of farms is 2.6 ha. Although some progress has been made, extensive production prevails which result, often, in outdated production techniques and low yields (MoFTER, 2009).

Concern for "sustainability" applies to institutions, as organisational structures, as much as it does to development, as a process. That's why sustainable rural institutions, meeting rural people's needs and expectations, are important for sustainable rural development (Uphoff, 1992). Therefore, agricultural and rural development can not be achieved without improving governance in Bosnian rural areas. Rural governance comprises mechanisms, institutions and processes of decisions making and implementation through which persons and groups articulate their interests, exercise their legal rights, meet their obligations and mediate their differences in rural areas (Cheema, 2005). Apart from institutions and processes governance in rural areas comprises also traditions and customs that determine how power is exercised, how people acquire a voice and how decisions are made on issues of public concern. Governance analysis focuses on the formal and informal actors involved in decision-making and implementing the decisions made and the formal and informal structures that have been set in place to arrive at and to implement decisions (Sheng *et al.*, 2007).

According to Uphoff (1986), institutions belong to the public sector (local administration and government), the participatory sector (voluntary organizations and cooperatives) and the private sector (not-for-profit service organisations and private businesses). Rural groups and institutions can be also divided into user groups, service providing organizations and governance institutions. In order to contribute to good rural governance, local institutions and organisations should be participatory, consensus oriented, accountable, transparent, responsive, effective and efficient, equitable and inclusive and follows the rule of law (cf. Sheng *et al.*, 2007). Civil society organisations in BiH are about 2,000 regional NGOs. Civil society sector is dominated by very small NGOs and women's and youth organisations. Most of larger NGOs have been established thanks to international assistance explaining high dependency on foreign funding and expertise. Rural development programming is largely dominated by an elite core of foreign-supported NGOs. In rural areas and small towns, CBOs (Community-Based Organisations) are characterized by a small size, and, often, by a low capacity and the lack of a long-term vision and a specific mission. An additional significant constraint is the relevant lack of coordination and cooperation among NGOs at the local and country level and between them and governmental bodies. Rural areas are characterized by community voluntarism growth and a continuous CBOs emergence but also with a significant degree of duplication and competition between them (Sterland, 2004).

In BiH and RS, rural governance models are slowly experiencing a paradigm shift towards the concept of "the new rural paradigm" (OECD, 2006). However, while there have been many attempts to design appropriate policies to improve the competitiveness of rural areas based on their specificities, in many cases rural development philosophy and practice are still top-down and subsidy-based. Government support to the rural sector evolved from command-and-control policies under socialism to support for transition where donors have an increasingly important role. However, increased emphasis

is needed on rural development support and improving public agricultural goods and services; *e.g.* extension and advisory services, agricultural education and research, etc. (Lampietti *et al.*, 2009).

Evidence from many European countries suggest that there is a strong relationship between governance and rural development policies design, delivery, and most importantly, impact on rural communities' livelihoods and quality of life. In fact, there are strong correlations between local institutions efficacy and effectiveness and rural development policies outcomes. Local institutions are involved in political but also social and economical governance in rural areas. New models of local rural governance are emerging with shifting power and resources downwards from the state to the regional and local levels through decentralisation, devolution and delegation processes. Rural societies are experiencing an increasing complexity of social interactions due to the emergence of new institutions especially civil society ones. The transfer of power from the state to rural people's agencies is a major institutional as well as organisational change. New models of local rural governance reflect a shift of rural development policies target from agriculture to a multisectoral approach, which also targets enhanced synergy and complementarity between rural sectors and to create public-civil society-private partnerships (OECD, 2006).

The main objectives of this work are: (1) to identify the main agro-rural development policies in BiH with a special focus on RS; (2) to identify the main public and civil society institutions involved in the design, implementation/delivery and evaluation of these policies and to try to understand the complex linkages between them; (3) to analyse relationships between local institutions and regional and national ones as well as with international donor organizations; and (4) to present and discuss policies and strategies to improve coordination and synergy between institutions in promoting sustainable agricultural and rural development in BiH with a focus on governance.

2. Materials and Methods

Methodologically, the work is based on an extended analysis of secondary information and on questionnaires and a semi-structured interviews with representatives of public and civil society institutions. Highly reliable secondary data from available reports, research papers and statistical databases have been used. All collected data have been analysed, cross-checked and validated.

A questionnaire, focusing on the design and implementation of agro-rural development policies in BiH and on the evaluation of coordination between the involved actors¹, have been sent by e-mail to

¹ Key questions included the operational level and the geographical coverage of each organization; the definition of "rural development" (sub-sector of agricultural development, cross-sectoral including agricultural sector, etc.); the involvement of the organization in a rural development policy and/or project and in which phase of the process (design, implementation/delivery, monitoring/evaluation); the level of its cooperation and coordination with other public, civil society and international organizations dealing with rural development in BiH in general and RS in particular. Additional inquiries were about the main political, technical/bureaucratic and strategic (strategy span – short-/medium-/long-term; vision, etc.) constraints that hamper coordination between organizations dealing with rural development and/or render it ineffective. Contact between institutions can allow them to strengthen their collaboration but can also generate tensions especially if they have different interests, visions, objectives and understandings of rural development that's why conflicts between the different actors were also investigated. Respondents identified also the organization that assumes, according to them, the leadership in coordinating rural development issues which allowed having an insight on the centrality of involved organizations and those in the core of the rural development network(s) in BiH and RS.

around 120 representatives of different institutions and organizations¹. In particular questionnaires were sent to key actors such as the State Ministry of Foreign Trade and Economic Relations and the Ministries of Agriculture, Forestry and Water Management of the RS and the FBiH.

Additional information about local institutions dealing with agro-rural development have been collected through phone interviews and meetings with representatives of some municipalities (Trnovo, Istocna Ilidza, Istocno Novo Sarajevo, Istocni Stari Grad, Pale, Sokolac and Rogatica) in Sarajevo-Romanija region (SRr) and of the town of East Sarajevo (TES).

The lack of adequate, reliable and updated secondary data have been one of the major constraints faced during this research.

3. Results and Discussion

The design and implementation of agro-rural development policies involve different supra-national or international, national and sub-national actors (regional; intermediate or sub-regional; and local) (OECD, 2006). In BiH, intermediate levels, entities of RS and FBiH, have a crucial role in agro-rural policies design and delivery. International organisations and development agencies have implemented different rural development projects and programmes during the post-war period.

In BiH, all levels of governance, ranging from the state to municipal authorities, are involved in the agricultural sector management and rural areas development. At the state level, the most important institution that deals with agriculture and rural development is the Ministry of Foreign Trade and Economic Relations of BiH (MoFTER). The organizational unit within MOFTER called Sector for Agriculture, Food, Forestry and Rural Development is responsible for establishing a framework for the development of sectoral strategies, policies, programs and measures, and for their implementation aiming to harmonize agriculture development in the country. The Veterinary Office and the Directorate for the Protection of Plant Health and Food Safety Agency are entitled to deal with animals health, plant protection, food safety and food quality control at the level of BiH. Besides the MoFTER, at the state-level also the Ministry of Finance of BiH² and the Directorate for European Integration (DEI)³ have some competencies in certain agriculture areas. There are some other institutions in BiH whose activities are directly or indirectly related to agriculture, such as: the Agency for Market Surveillance⁴,

¹ Different types of public and civil society institutions and organisations have been considered including, among others: Ministries, government institutions and executive agencies (*e.g.* extension organizations, etc.); Public structures (training and research centres, universities, etc.); Users' organizations (*e.g.* farmers' union, cooperatives, associations, etc.); National and international NGOs and civil society organizations; donors and cooperation agencies (*e.g.* USAID, DFID, SIDA, GTZ, etc.); Financial institutions; International organizations (FAO, IFAD, etc.); etc.

² The Department for funding programs and projects of EU assistance within the Ministry of Finance of BiH deals with issues related to finance, procurement contracting, payment, monitoring and controlling implementation of all programs and projects of Euaid in BiH, including those in the field of agriculture.

³ DEI is the main operating partner of the European Commission (EC) in the process of Stabilization and Association, which coordinates all levels of administration in issues related to European integration strategy and policy, law harmonization and aid coordination in all areas, including agriculture.

⁴ It is responsible for informing about unsafe, risky and dangerous products.

Statistics Agency (collection of statistical data), the Institute of Intellectual Property¹, the Institute for accreditation² and the Institute for Standardization³.

The state policy in the agricultural sector, food and rural development in recent years is developed in accordance with the goals and needs for accession to the EU which is possible only with the active participation of all stakeholders in the agricultural sector. However, establishment of main structures for receiving and managing the pre-accession funds is still a challenge.

Systematic and structural harmonization of agricultural policies at the state level began with entry into force of the Law on Agriculture, Food and Rural Development of BiH, adopted in May 2008. The Law regulates definitions of terms to be used in the agriculture, food and rural development sector legislation, the objectives, principles and mechanisms for development of strategies and policies, the structures and competencies at all governance levels, institutional support structures and services and their functions and linkages, monitoring and evaluation mechanisms, and administrative and inspection supervision. The measures of the Law are basically classified into policy measures to support agricultural markets and measures for rural development. Policy measures to support agricultural market are divided in the measures to improve products quality, measures of direct support to agricultural farms and measures for foreign trade. Measures related to rural development encompass those measures aimed at increasing competitiveness, protecting rural environment, diversifying activities in rural areas and improving life quality in rural areas. In accordance with the Law on Agriculture, Food and Rural Development were established the Committee for the Coordination of Information in Agriculture (March 2009), the Working Group for Coordination of Extension Services in BiH (June 2009), Advisory Council for Agriculture, Food and Rural Development (July 2009), Agricultural Market Information Service of BiH (August 2009).

Moreover, the MoFTER, supported by the European Commission (EC), prepared Strategic Plan for the harmonization of BiH Agriculture, Food and Rural Development 2008-2011 and Operational Programme for the harmonization of BiH Agriculture, Food and Rural Development 2008-2011 (both were adopted by the Council of Ministers of BiH in September 2009). The key objective of the Strategic Plan is to provide a framework for the gradual harmonization of policies, programmes, institutions, laws, regulations, systems and services both within B&H and with the EU while operational programme define six priority areas of them three are related to rural development: improving agro-food sector competitiveness; protecting the rural environment by supporting agro-environmental programs; and diversifying rural activities and improving quality of life in rural areas.

At the level of entities, institutions in charge of agricultural sector management are the Ministry of Agriculture, Forestry and Water Management in the RS and the Federal Ministry of Agriculture, Forestry and Water Management in the FBiH while Brcko District local administration has its own Department of Agriculture, Forestry and Water Management. In FBiH the system of responsibilities is further divided, so all 10 cantons have established departments for the issues of agriculture, veterinary medicine, forestry and water. Ministry of Agriculture, Forestry and Water Management of RS established the Agency for

¹ It is in charge of administrative procedures relating to the industrial property rights- patents, geographical indications, etc.

² It is responsible for the preparation and publication of the lists of accredited laboratories, certification and inspection bodies, etc.

³ It represents BiH in European and international standards harmonization organizations.

Agricultural Payments as an administrative organization within the Ministry. The Strategic Plan for Rural Development 2009-2015 was adopted in the RS (November 2009), work is in progress in the FBiH, while the Development Strategy of Agriculture, Food and Rural Development in the Brčko District of BiH was prepared in 2008 for the period 2008-2013.

Moreover the agricultural and rural sector is characterized by the presence of a number of international donors, such as the USAID, SIDA, Italian Cooperation, JICA, AECID (Spain), the European Commission, the World Bank, etc. However from 2009, due to world economic crisis, the investments of donors in BiH have decreased.

Financial support to individuals or companies involved in agriculture and rural development is provided also by micro-credit organizations and banks. Under adverse conditions. Federal Investment Bank and the Investment Development Bank of the RS have special kinds of credit lines aimed to help agriculture and rural development.

In the RS in general and SRr in particular, support for rural development by municipalities is partly stated in local planning documents, which include the Local Economic Development Strategies. Many local organizations are operating in municipalities. Most of them have a predominant charity character largely due to the consequences of the civil war¹. Sport, cultural, youth and students' organizations are present in a large number as well. Those involved in agro-rural development are mainly agricultural cooperatives, environmental associations, associations of entrepreneurs and cultural heritage preservation associations. Financial and technical support for NGOs and cooperatives is provided by local budgets. In all municipalities financial aid is guaranteed for those NGOs that are identified as organizations of public interest (*e.g.* organization of war veterans) while cooperatives and remaining NGOs have to submit specific projects to be eligible for funds from local and regional budgets. Rural development strategies, plans and programmes are generally missing at local and regional level: Pale municipality has a strategy for development of agriculture, while in municipalities of Istocni Stari Grad and Istocno Novo Sarajevo preparation of this document is still in progress, and the other four surveyed municipalities (Trnovo, Istocna Ilidza, Sokolac and Rogatica) do not have any strategic document related to agriculture and rural development with the exception of Rogatica where is foreseen the preparation of a Local Environmental Action Plan (LEAP). Overall in the 2006-2010 period, local development strategies focused mainly on agriculture development rather than on rural development, however the trends, generally, show an increasing attention paid to non-agricultural activities. Nevertheless, it seems that there is a consistent lack of coordination between local institutions operating in rural areas. Rural actors should consider their interaction as a win-win deal in order to be motivated. Attention should be paid to the functional relationship between sustainability, organisational maintenance and satisfaction of the needs of the partners involved.

The questionnaire for evaluating the level of coordination between the actors dealing with agro-rural development policies in BiH encompassed the main public institutions and civil society organizations dealing with rural development in municipalities, cantons, regions, and entities as well as at the state level. 67% of respondents were public institutions and 33% civil society organizations.

¹ Associations for disabled people, war veterans, drugs addicted, refugees, displaced persons, etc.

Almost half of the respondents operate at local level (46%), at entity level (40%) while only less than a third (27%) operate at the state level. Some institutions operate at two or even three levels at the same time and that explains why the sum of percentages is higher than a 100%. However, some differences can be noticed between public and civil society institutions. In fact, public institutions are more present at the entity level (60%) than civil society organisations that are more present at the local level (60%) and only 40% of them operates at the state level.

Most of respondents consider rural development as a cross-sectoral issue that includes the agricultural sector, while some of them provided their own definitions¹.

All interviewed organizations are involved in design (67%), implementation (73%), and monitoring/evaluation (53%) of agro-rural development policies. Public institutions are mostly involved in design (90%), and less in implementation (60%), and monitoring/evaluation (60%). As expected, civil society organizations are fully involved in the implementation phase (100%) and less in policy design (20%) and monitoring/evaluation (40%).

Almost all interviewees (93%) answered that they have had relationships with public institutions while most of them have had relationships with civil society and international organizations (86%). 67% of institutions contacted have collaborated with at least five public institutions, 60% of them have collaborated with at least five civil society organizations while 27% of them have collaborated with at least five international organizations.

60% of respondents evaluate the coordination among the different actors as effective while around 20% of them evaluate it as not effective (20% of them did not provide any answer).

The main constraints and problems impeding a good coordination between involved actors in the design and implementation of agro-rural development policies mentioned by the respondents are included in box 1.

Only 53% of respondents identified an organization as having the leadership in coordinating rural development issues while 20% of respondents did not recognise any leader organization (27% of them did not provide any answer). The institutions more widely identified as the most important in providing a coordination of rural development issues are the Entity's Ministries for Agriculture while no public institution or civil society organization considered the Ministry of Foreign Trade and External Relations (MoFTER) as the leader institution regarding these issues. In fact, it is quite common in the decentralised or 'concerted' and multi-actors driven rural policy design and delivery systems (Mantino, 2009) that the different levels of government find it difficult to clarify their respective roles and responsibilities (OECD, 2006).

¹ e.g. Federal Ministry of Agriculture, Water Management and Forestry (FBiH); According to Article 3 of the Law on Agriculture, "*Rural Development is a set of policies, measures and activities aimed at a comprehensive economic, social and cultural development of the population in rural areas, and which are planned and implemented respecting the principles of sustainable development, preserving and improving the quality of the environment...*" (Official Gazette of the FBiH 88/07).

*Box 1. Major constraints hampering coordination of agro-rural development policies in BiH.
Source: authors.*

- Lack of knowledge and information
- Lack of communication and coordination among key actors
- Lack of qualified human resources in institutions and organizations dealing with rural Development¹
- Lack of understanding and of a common vision of rural issues and priorities
- Lack of clearly defined plans, initiatives and long term strategies
- Lack of funds
- Conflicts of interests
- Absence of a dialogue culture and participatory approaches
- Low use of information technologies
- Low attention paid to rural areas in the political agenda
- High level of administrative and bureaucratic requirements
- Delay in the establishment of the Federal Agency for Rural Development mentioned in the Agriculture Strategy of FBiH (2006–2010)

Respondents also mentioned some institutions with which they have had some conflicts. It is interesting to note that public institutions have mainly conflicts with governmental organisations and some international agencies while civil society organisations, also due to their nature, present a lower degree of involvement in those conflicts.

Overall most of the interviewees identified the main constraints in coordination among the different organizations dealing with rural development as political (40%), technical (60%) and strategic (80%). Some respondent also emphasized that in some cases competition is overcoming cooperation thus resulting in a major constraint.

The analysis of relationships and linkages between the institutions that are involved in the design and implementation of agro-rural development policies in BiH and RS showed a lack and/or weaknesses of coordination between them. Therefore, this problem should be addressed as soon as possible in order to increase the effectiveness of these policies and their impacts on rural people's livelihoods. A basic action to strengthen coordination would be to encourage dialogue between these institutions. While "formal dialogue" does exist between some public institutions especially those operating in RS and with some international NGOs and donors, it seems that a lot need to be done in order to involve civil society and private sector organizations especially during the design and formulation phase. That is critical especially regarding the participation of rural people, farmers and their organizations. Developing strong partnership between national and sub-national governments through vertical governance arrangements and public-civil society partnering agreements can make Entity, regional and local governance institutions responsible by virtue of their participation in decision making regarding the design and implementation of rural development policies (OECD, 2006). Since local actors are called to perform new tasks, which requires changes in mind set and new skills, governmental institutions and international organisations should help local actors to acquire these new skills.

¹ e.g. in the Department for Rural Development in the Federal Ministry of Agriculture, Water Management and Forestry (FBiH) there are just two (2) employees while they should be eight (8).

One of the obstacles that hamper coordination between civil society organizations and between them and public institutions is a lack of a common understanding of what is “rural” and what is “rural development”. The questionnaire suggested that despite the fact that all organisations consider rural development as cross-sectoral they mean different concepts when they talk about rural development therefore they use different approaches and they have different priorities which make difficult to have a common vision for a mutual identification, formulation, implementation, monitoring and evaluation of agro-rural development projects.

In order to strengthen coordination and synergy between institutions in promoting sustainable agriculture and rural development in RS it is also necessary to harmonize entity laws and regulations with the Law on Agriculture, Food and Rural Development of the BiH, that is, to a certain extent, in line with the rural development measures of the EU. That can make it easier also for international donors and NGOs to formulate their strategies for agro-rural development in all BiH. Among the most urgent priorities it should be included the adoption at the entity level of the BiH’s Operational Program for the Harmonization of Agriculture, Food and Rural Development 2008-2011 in order to implement the Strategic Plan for the Harmonization of Agriculture, Food and Rural Development in BiH (2008-2011).

Human capital has also a strategic relevance in order to achieve a good coordination between involved institutions. In fact, institutions’ staff can operate in such a way to reduce transaction costs and to render communication smoother and flow of information faster. Communication and exchange of information could be made more effective thanks to the new ICTs (Information and Communication Technologies). It is critical to strengthen staff capacities in the State and Entity institutions, particularly the analytical and communication skills. In fact, since rural policy is strongly knowledge-based and multi-stakeholders, co-ordination and communication mechanisms play a key role in the design and implementation of place-based rural development policies. Communication should be developed horizontally, at the central, entity, regional and local levels, as well as vertically, across different government tiers (OECD, 2006). Motivation and incentives to public institutions’ staff can help in achieving this objective. That would allow to strengthen coordination and cooperation between them thus ensuring effective and efficient implementation of policies, programs, action plans and strategies and avoiding overlapping in responsibilities and activities which would allow also to save precious financial resources especially considering that with the world financial and economical crisis budget cuts and austerity plans have been adopted everywhere including in BiH.

A better coordination between involved institutions means not only to reduce institutions operating and transaction costs but also to manage effectively incentives and subsidies provided to farmers and rural dwellers and to avoid frauds, corruption and “*clientelism*”. That is true also in the case of the use of IPARD (Instrument for Pre-Accession on Rural Development) funds. Coordination is easier when all institutions have access to all information regarding agro-rural development that’s why it is crucial to speed up the establishment of information systems in agriculture such as the Farm Register, the Client Register, the Agricultural Market Information System (PTIS-a), a system for monitoring and evaluation in the sector of agriculture, food and rural development, etc. Moreover, financial support, from the EU and other international donors and cooperation agencies, should be provided not only for the establishment of these services but also for their operation and maintenance. A stronger partnership between Bosnian institutions dealing with rural development and those of the EU and its Member States can help to ensure a better cross-fertilization and exchange between them which can have positive

impacts on their *modus operandi*. It is not the case of the transfer of a specific model or approach, but of the adoption of best practices and innovative solutions that should to be remodelled considering the specific institutional and political contest of BiH in general and in RS in particular.

Moreover, many of the solutions proposed by Bryden (2005) in order to address key coordination challenges and to achieve an effective governance are suitable also in the case of BiH.

4. Conclusions

Lack of a good coordination between actors dealing with agro-rural development policies decrease their effectiveness. Vertical co-ordination between State level institutions with Entity, regional and local ones, especially civil society organisations, is still particularly challenging in BiH. State and Entity governments should encourage local actors' participation in the design and implementation of place-based policies for rural development. That means governmental and public institutions should redefine their role and devise new multi-level cooperation and coordination frameworks that emphasise power sharing between different governance levels and inter-dependence and partnership between a wide range of actors in agro-rural policy making. It goes without saying that the ease of vertical coordination between the different levels of governance also depends on the degree of horizontal coordination especially at the level of entities (RS and FBiH). Coordination between the Sector for Agriculture, Food, Forestry and Rural Development of the State Ministry of Foreign Trade and Economic Relations; the Ministry of Agriculture, Forestry and Water management of RS; the Federal Ministry of Agriculture, Water Management and Forestry (FBiH) and the Department for Agriculture, Forestry and Water Management of Brcko District (BD) is of a crucial importance. Coordination with other state and entity ministries and development agencies is also relevant. Civil society organisations, especially user ones, should be involved also in the design and evaluation and monitoring of agro-rural development in order to make sure that policies are effective and to improve them.

In order to increase their impact, agro-rural development policies in BiH should be place-based, multi-sectoral, synergistic and designed and implemented through a good coordination between multilevel governance institutions. Although good governance is not sufficient on its own it is indispensable to sustain Bosnian rural territories development over the longer term. In the context of rural development, good governance should not be seen as an objective on its own, but a means to improve the living conditions of the rural communities by contributing to more appropriate and effective, and better coordinated services, based on participatory decisions, transparency and accountability. Dialogue and cooperation between state, entities, cantons, regions, municipalities and non-state actors are essential for promoting rural development. Local governance is to be put into the context of a wider process of institutional reforms and rural service delivery systems encouraged by the EU and many other development agencies.

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