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## Supply Chain and ICT Issues of Estonia: Survey Findings

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### Abstract

Logistics and supply chain management are critical for economic sustainability. In this research, we aim to identify the most critical factors to logistics and supply chain performance for a small open economy by reporting survey results from Estonian manufacturing, trading and logistics service companies. By comparing survey results from 2012 and 2018, we also analyze how these critical factors may have changed during the last years. In the survey, the significance of competitiveness, functionality of logistics, and information and communication technologies (ICT) among others were included. The results indicate that the importance of factors such as purchasing, demand forecasting and operations planning have increased. Overall, purchasing and demand forecasting are considered more important than other factors. Surprisingly, logistics was considered less vital in 2018 than in 2012. Most of the current challenges in companies arise from demand management (forecasting and planning), increasing labour costs and regulatory changes. On ICT side change has been from traditional communications more towards digital, and especially using specific platforms (portals, intranet/extranet).

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### 1. Introduction

Due to globalization and expanding markets companies early-on identified the value of supply chains and networks. Financial performance and general competitiveness is not anymore produced alone, but within groups of

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geographically dispersed actors [1][2], [3][4], [5]. Similarly, new product development and innovation processes spread around a network of actors, and doing everything alone is no longer effective [6]. These two changes mean more collaboration and working in formal, but also within informal networks. The ultimate test for companies, supply chains, networks and actors is the value received by customer and end-user – they would eventually judge, which products would succeed or fail [7]. In the recent decade environmental issues, demand for sustainability and new regulation have further changed the environment where companies operate [8]. All of this have resulted on significant changes in supply chain management and logistics. Competition has increased, demand is more unpredictable (resulting on swings in inventories and orders) and cost levels are changing due to for example wage inflation and environmental regulation. In addition, the pace of development of Information and Communication Technologies (ICT) is increasing, causing additional pressures for the competitiveness of supply chains. Supply chains and networks also face numerous disruptions from external sources, like in the form of earthquakes [9], storms [10], floods [11], [12], fires [13], flaws of raw materials [14] and diseases spreading in the form of viruses [15].

Small economies and countries face the criticality of supply chain and logistics competitiveness. Best examples in the world have shown big thrive to prosperity (e.g. Singapore, Hong Kong, Sweden, Denmark, Norway, Finland, Baltic States, and Czech Republic), while countless other economies have regressed to very low levels of prosperity and foreign trade (e.g. numerous small Eurasian landlocked countries and South American ones). Our research concerns one of the most open economies in the world, Estonia. Country is small, with population of 1.3 million, but very dependent on foreign trade (somewhat above 70% in exports, while slightly below in imports from GDP during 2019; [16]). Exports of goods and services from Estonia made up around three quarters of GDP in 2018-2019, putting Estonia in 11th place among the countries of the European Union for openness [17]. In addition, it has in the recent decades grown significantly in economic terms (and joined successfully e.g. Eurozone in 2011, [18]), despite many challenges (e.g. Russian and EU setting sanctions to each other, and effect of ageing population) and small size of domestic markets. In 2019, Estonia rose up one place further in the Global Competitiveness Index rankings to 31<sup>st</sup>, and was 14<sup>th</sup> among the 28 countries in the European Union. Estonia was the highest placed among the countries of Central and Eastern Europe (CEE) and got good marks for its macroeconomic stability, which takes in the low level of government debt, strong institutions, a flexible labour market, a good level of education, and a highly-developed digital society. Small domestic market and the low level of capitalization unfortunately pulled down Estonia's position [17].

As logistics and supply chain management are critical for economic sustainability of a small economy, this will be the core research task of completed Estonian logistics survey. Our research problem could be stated through following research questions: “What factors are the most critical and challenging for Estonian companies regarding logistics and supply chain management performance?”, and “How performance and importance of different areas has changed from 2012 to 2018?”

These questions are answered by analyzing empirical material from a series of logistics surveys carried out among Estonian manufacturing, trading and logistics companies. The last survey executed in collaboration between two universities, namely Tallinn University of Technology, Estonia and University of Turku, Finland and it was completed in May-October 2018. Kiisler et al. [19] presents some results of this survey. The previous similar surveys have been made in 2007 [20] and 2012 [21], [22].

The data was collected through an Internet questionnaire (three separate versions for respondents from manufacturing, trading and logistics sectors respectively) executed in May-June 2018 in which a personal link was sent by email to sample companies asking them to take part in the survey. After the initial invitation, the companies were sent two reminders in two-week intervals.

The sample of Estonian logistics survey in 2018 consisted of 2500 Estonian manufacturing, trading and logistics companies. By Statistics Estonia, in 2018 there were 131 650 economically active enterprises in Estonia [23]. Majority (94%) of them had less than 0-9 employees. 6548 companies had 10-49, 1172 companies had 50-249 and 186 companies had 250 and more employees. So it can be said, that all more significant Estonian manufacturing, trading and logistics companies were included into survey sample.

At total 122 representative responses were received (return rate being 4.9%). As results in this study are compared to year 2012 survey, in this previous study 5000 companies were contacted (from manufacturing, trading

and logistics) and 97 responses were received. In the following amount of observations varies as we analyze sub-groups of total respondent population and not necessarily all respondents have wanted to respond on all questions.

This research is structured as follows: In Section 2 we review the results of surveys (2012 & 2018) concerning the value of logistics and supply chain management for the performance and competitiveness. Drawbacks of supply chain functioning analysis from survey results follow in Section 3. Aspects of ICT usage and application are analyzed in Section 4. Research is concluded in Section 5, where we also propose avenues for further research.

## 2. Value of Logistics and Supply Chain Management for the Performance and Competitiveness of Estonian Companies

Figures 1 and 2 present the value of different logistics functions for the competitiveness of Estonian manufacturing and trading companies in 2018 and 2012. For assessing the value 5-point assessing scale was used by respondents (1-very small; 2-small; 3-neither small nor large; 4-large; 5-very large).

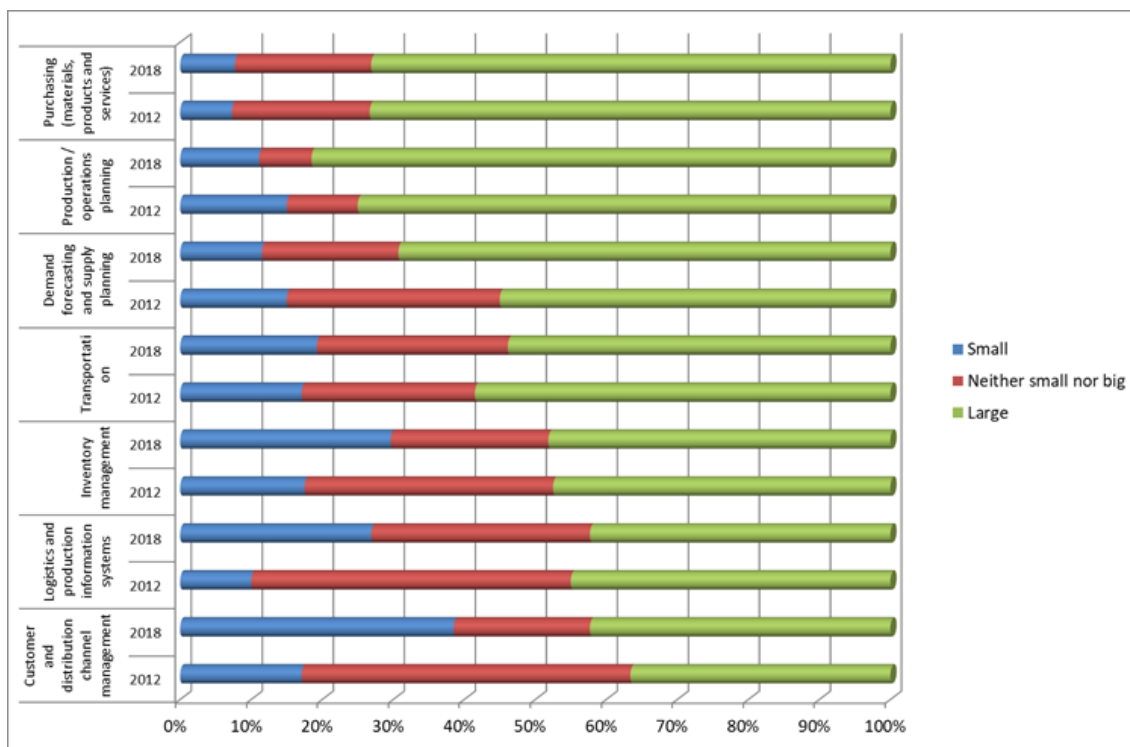


Fig. 1. The value of several logistics functions for the competitiveness of Estonian manufacturing companies in 2012 and 2018 (ranked by average rating of respondents on decreasing order; 2012: n=42; 2018: n=27).

The three most important logistics functions for the competitiveness of Estonian companies can be outlined. Two of these are common for both manufacturing and trading sectors: purchasing and demand forecasting. One differs by industries – this is production planning for manufacturing and inventory management for trade sector.

Majority of responded manufacturers (73%) assessed the importance of purchasing function for their competitiveness as large or very large, including very high share of "very large" answers (average rating 4.0). From manufacturers 82% manufacturers (with average rating of 3.9) production/operation planning function importance was estimated as large or very large. Out of responses, 67% gave the same rating for demand forecasting and supply planning function (average 3.7).

Purchasing is a logistics function having also the largest value for the competitiveness of Estonian trade sector – 73% of responded traders rated this large or very large (average rating 3.7). Purchasing is followed equally by the demand forecasting and inventory management functions (67% and average rating 3.7 for both).

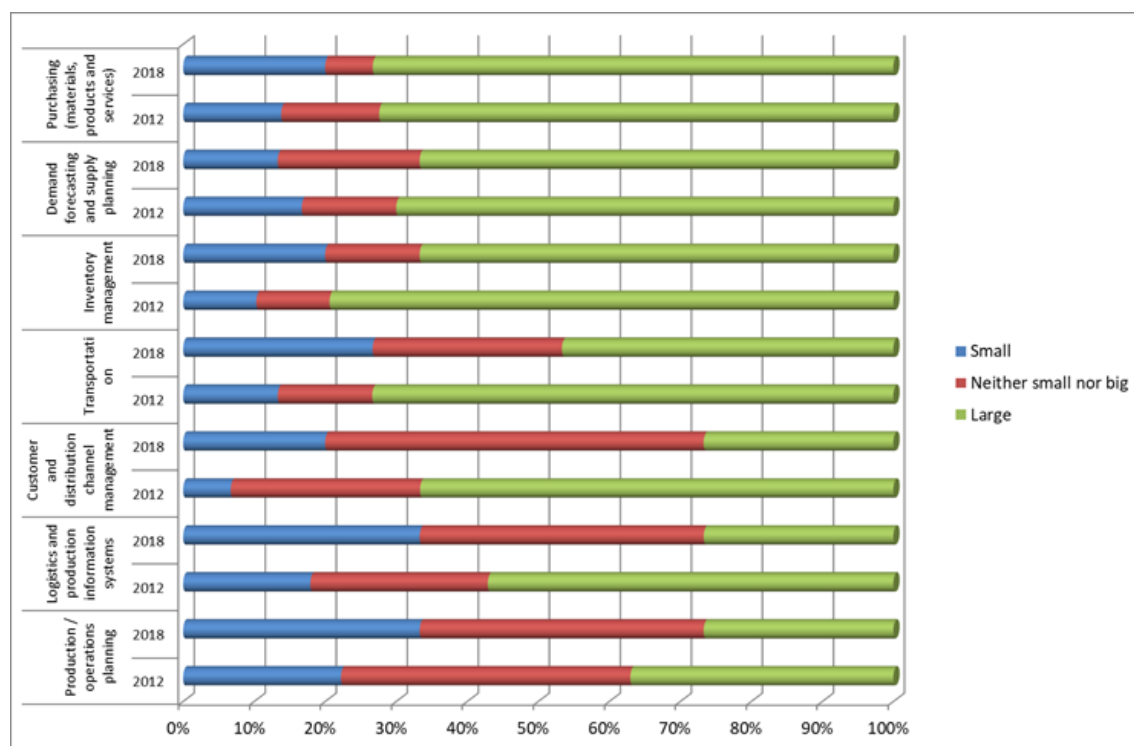


Fig. 2. The value of several logistics functions for the competitiveness of Estonian trading companies in 2012 and 2018 (ranked by average rating of respondents on decreasing order; 2012: n=31; 2018: n=15).

In Estonian trading companies the value of customer and distribution channel management, logistics production information systems and transportation function for the competitiveness have considerably decreased in 2018 in comparison with year 2012 survey results.

Surprisingly both surveys (from 2018 and 2012) show that manufacturers and traders alike assess the impact of logistics and production information systems on competitiveness of company quite low. In 2018 only 42% responded manufacturers and 27% traders considered these value for importance big or very big (45% and 58% in 2012 accordingly).

One survey question asked respondents to agree or disagree with several statements about the role of logistics in the company in five-point scale (1-totally disagree; 2-disagree; 3-neither disagree nor agree; 4-agree; 5-totally agree). The results are shown in Table 1. In comparison with results of similar surveys from 2012 and 2007, the assessments of the role of logistics in company's operations have significantly decreased. While results of year 2012 survey showed the increasing role of logistics in companies operations compared with survey from 2007, the year 2018 survey results show the reversal of this trend. Probably the logistics / SC management has been shaded by the sharp increase of labor costs in Estonia. For example, during five-year period 2013-2018 average monthly labor cost per employee was increased 39% (from 1346 to 1868 euros), average hourly gross wage 34% (from 5.97 to 7.97 euros) and average gross wage 40% from 992 to 1391 euros [24]. These developments have continued up to the corona virus lockdown since March 2020.

It should be mentioned, that by surveys results, Estonian companies assess the importance of logistics for their performance surprisingly low in comparison with other (Baltic Sea region) countries already from the start of this century. [20]

Also the second reason for low agreement rates with statements in 2018 could be the contemporary problems of respondents to define the scope of logistics in their companies. Logistics and supply chain management are very popular terms, but meaning, scope and responsibilities of these may vastly differ by respondents' companies. It is possible, that some respondents' understood under logistics only transport or transport and warehousing functions, which are direct responsibilities of logistics managers or specialists in many companies and did not accounted e.g. inventory management, purchasing, order fulfillment etc. functions being considered under logistics in this wider meaning.

Table 1. Estonian manufacturing and trading firms' assessments of importance of logistics in the company, 2018 (n=98) and 2012 (n=73).

Statement		Disagree	Neither disagree nor agree	Agree
Logistics has a major impact on our profitability	2018	52%	32%	16%
	2012	36%	23%	41%
Logistics has a major impact on our customer service level	2018	36%	34%	30%
	2012	38%	14%	48%
Logistics is a key competitive advantage for our firm	2018	48%	27%	25%
	2012	36%	25%	40%
Logistics is a top management priority in our firm	2018	59%	18%	23%
	2012	32%	33%	35%
Logistics has a major impact on our cost efficiency	2018	48%	25%	27%
	2012	26%	39%	35%
Our logistics solutions have a significant impact on other actors	2018	33%	21%	47%
	2012	24%	24%	53%

As a rule, trading companies value logistics / SCM much more than manufacturing ones. On the average 41% of responded traders and 21% manufacturers agreed the statements presented in Table 1 (average share of disagreed respondents 37% and 51% respectively, the rest of respondents being neutral). The less agreed statements, both by manufacturers and traders were that logistics is a top management priority in their firms (59% of all respondents, 62% manufacturers and 53% traders disagreed) and that logistics has a major impact on their profitability (52%, 59% and 40% accordingly). The most agreed statements were the following: "Our logistics solutions have a significant impact on other actors" (e.g. supply chain partners, competitors etc.; 47% all respondents, 41% manufacturers and 57% traders agreed) and "Logistics has a major impact on our customer service level" (30%, 24% and 40% accordingly).

Among trading companies responded, for statements such as "Logistics has a major impact on our customer service level", "Logistics have a major impact on our cost efficiency" and "Logistics is a key competitive advantage for our firm" the agreements exceeded disagreements or were equal with these. Among manufacturers' disagreements with before mentioned statements exceeded agreements.

### 3. Main Drawbacks of Functioning of Supply Chains in Estonia

Figure 3 presents the opinions of Estonian manufacturers and traders about the factors having the most negative impact on the functioning of their supply chains in the recent past (during the last two years) in 2018 and 2012.

These negative impacts are rather moderate. By the results of both surveys, the high demand variation or difficulties in forecasting demand are factors having the biggest negative impact on supply chains. The impact of weak availability of competent personnel has only slightly increased from 2012 despite the fact, that differently from year 2012, in 2018 the number of vacancies in Estonia strongly exceeded the number of unemployment [25].

Therefore, the lack of labor, being a problem for many Estonian industries since 2014, has not influenced availability of logistics and supply chains related specialists too strongly. Partially this could be explained by the simultaneous shrinkage of the LSP sector in reasons related to fuel taxation [26] and regulation changes (like vignette payments for road freight; [27]) in Estonia as compared neighbouring countries (Latvia and Lithuania have implemented similar changes and increased costs, but with lower rates of growth). In addition, the negative impact of availability differs (and differed also in 2012) by manufacturing and trading sector, being more felt for manufacturers (3.3 versus 2.5 by average respondents assessments).

In comparison with year 2012 survey results, in 2018 the negative impacts on functioning the supply chains caused by customers' payment problems, insufficient performance of suppliers and high demand variation have decreased. At the same time changes in regulations (e.g. excise taxes increase, change of income tax accounting system), low service level of LSPs and weak availability of competent labor have made more negative sense.

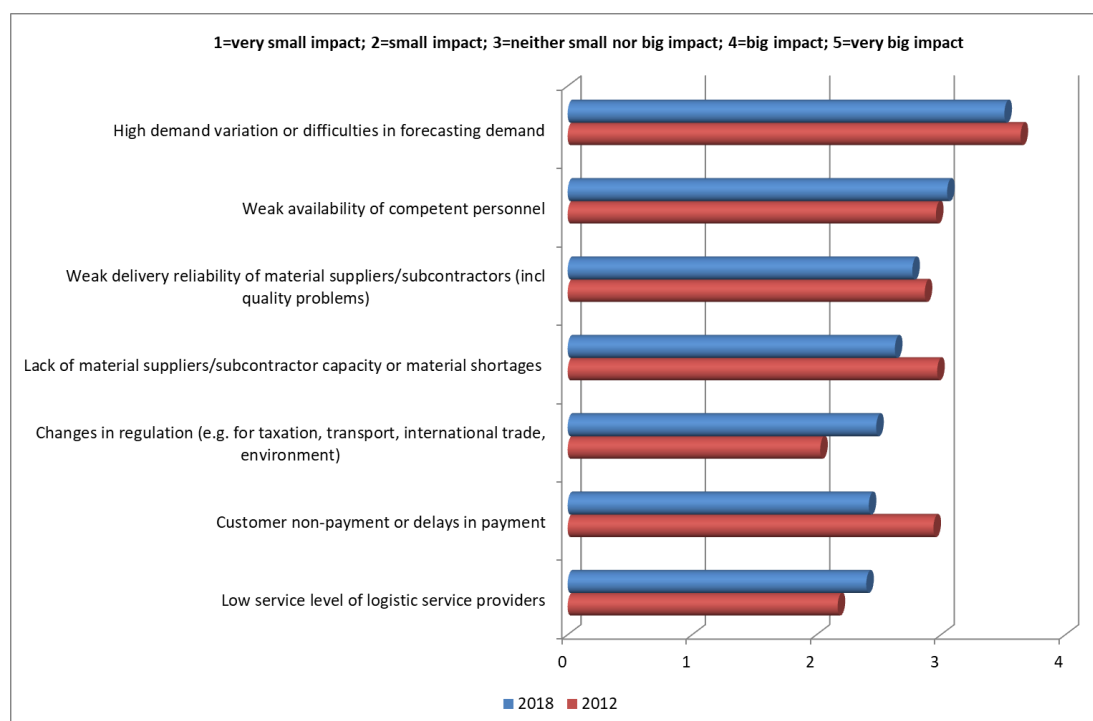


Fig. 3. Main drawbacks having an impact on the functioning of supply chains of Estonian manufacturing and trading firms during last two years, 2018 (n=43) and 2012 (n=71).

#### 4. Use of ICT Systems in Logistics and Supply Chain Management

As shown in Figure 4, the most widely used ICT method for managing order-delivery processes, is conventional email (92-100% by sectors), followed by web-based portals and conventional surface mail / phone / fax communication. From sub-groups of respondents, it seems that trading companies and LSPs are more versatile in the use of different ICT communication methods as compared manufacturers. However, manufacturers and traders have specifics in their ICT usage as these both typically use more ERP systems and barcodes (as compared to trading companies).

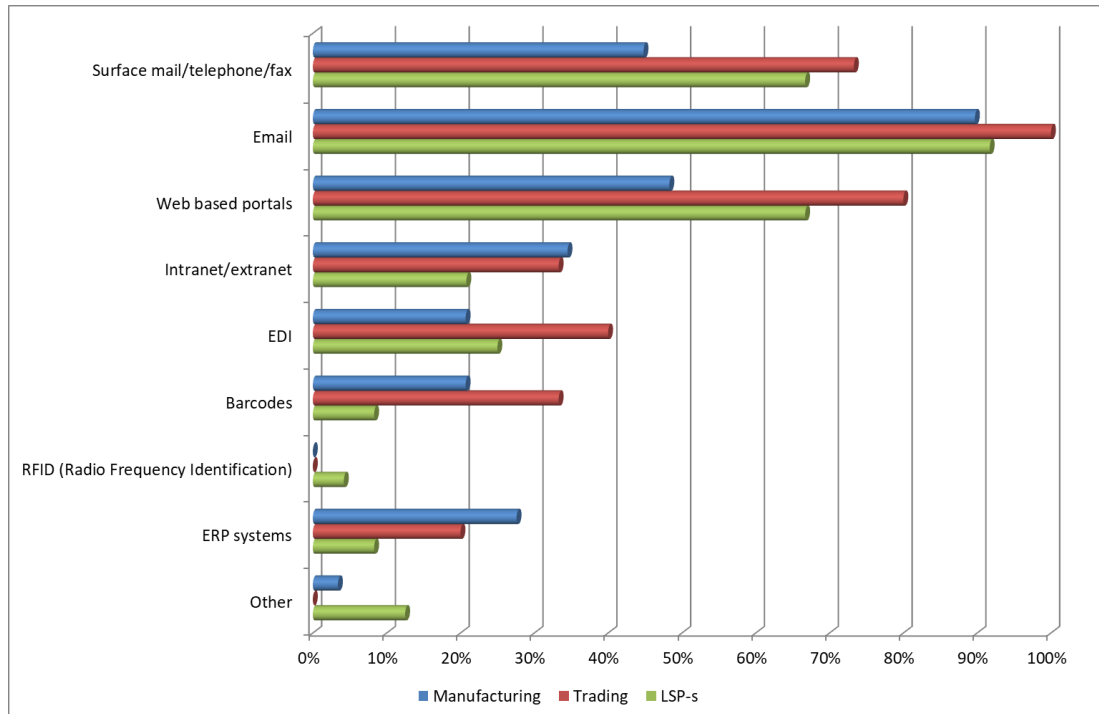


Fig. 4. The use of different ICT methods on a weekly basis for managing order delivery process in Estonian companies during 2018 (n=68).

Table 2. ICT methods on a weekly basis for managing order-delivery process in Estonian companies in 2018 (n=97) and 2012 (n = 68).

ICT method	Manufacturing		Trade		LSP-s	
	2018	2012	2018	2012	2018	2012
Surface mail / telephone / fax	44.8%	73.8%	73.3%	83.9%	66.7%	87.5%
Email	89.7%	95.2%	100.0%	100.0%	91.7%	91.7%
Web-based portal, e. g. Internet marketplace	48.3%	31.0%	80.0%	48.4%	66.7%	50.0%
Intranet / Extranet	34.5%	19.0%	33.3%	29.0%	20.8%	4.2%
Electronic Data Interchange (EDI)	20.7%	26.2%	40.0%	29.0%	25.0%	33.3%
Bar codes	20.7%	21.4%	33.3%	29.0%	8.3%	16.7%
RFID (Radio Frequency identification)	0.0%	2.4%	0.0%	3.2%	4.2%	0.0%
Enterprise Resource Planning System (ERP)	27.6%	26.2%	20.0%	3.2%	8.3%	12.5%
Other	3.4%	9.5%	0.0%	16.1%	12.5%	0.0%

Some common (and rather expected) trends can be outlined in comparison with similar survey from 2012 (Table 2):

- The share of conventional surface mail / telephone /fax (mainly phone) has continuously decreased. In 2012, these communication types were used by 74% responded manufacturers, 84% traders and 88% LSPs on a weekly basis for managing order delivery process. In 2018, these shares were 45%, 74% and 67% accordingly.
- The share of e-mail use has been remained stable since 2012.
- The use of web-based portals (e.g. company websites) has increased considerably. If in 2012 website portals were used in routine order delivery process by 31% of responded manufacturers, 48% trades and 50% LSPs, these shares were grown to 48%, 80% and 67% respectively in 2018.
- The use of Intranet and extranet in order delivery processes has also expanded. In 2012 this was practiced by 19% responded manufacturers, 29% traders and 4% LSPs. In 2018, these shares were 35%, 33% and 21% respectively.

- The use of RFID is still not spread in Estonia. Among the respondents of year 2018 survey, there was only one (logistics) company using RFID technology in order delivery process. In year 2012 survey, there were two RFID users (from manufacturing and trading sector).

## 5. Conclusions

It could be concluded from completed survey that from the point of view of Estonian manufacturing firms most important logistics / supply chain functions for the competitiveness are purchasing, production / operations planning and demand management (forecasting and planning). These functions for trading companies are purchasing, demand management (forecasting and planning) and inventory management. If something could be said from overall responses of these both sub-groups, it could be stated that in year 2018 survey purchasing and demand management (forecasting and planning) were rated commonly as most important functions. These same functions were involved within drawbacks of supply chain functionality. Most important item was the difficulty to meet varying demand and forecasting it correctly. In addition, supplier delivery reliability was ranked as third most important factor constraining supply chain functionality. In addition to these, companies also identified in 2018 higher challenge with recruiting of competent personnel. Based on survey, we detected decreasing valuation of logistics, which could be explained by the fact, that logistics practices / supply chains have become a routine, where less new things have been introduced, (which takes time and elaboration to get smoothly working). Maybe supply chains have been even stagnated (low service level of LSP-s has increased in Fig 3, but this could be that low service level of LSPs has been caused by their difficulties, like fuel excise). Anyway, lack of supplier capacity and weak delivery reliability has improved in Fig. 3.

On ICT side Estonian supply chains are increasingly digital nowadays, and conventional (old) communication using surface mail, telephone or fax has decreased in importance (as compared to 2012), where email is nowadays most popular method used (as it was also in 2012). In addition to this, web based portals and intranet/extranet were playing important role in ICT, and their popularity has increased from year 2012. From current and previous logistics surveys, we may conclude that IT changes in rather slow fashion as logistics is a conservative branch – barcode and EDI usage level has been relatively stable from the start of the century, while ERP use from the start of the second decade.

Regarding limitations of this study, we may argue that respondent size (organization) was relatively small, and this survey has been made from small European country (although, it could act as a proxy for other developing former East European logistics markets). As measured with the amount of employees, 19.7% respondents were micro- and 42.6% small companies, bring these in total to the level of 62.3%. In turnover terms these two groups accounted 68.8 % from answers. Therefore, these findings are rather from smaller company perspective, and are evidently biased in terms of size.

As a further research, it would be natural to continue completing this survey in forthcoming years. Recent changes in markets during 2019, like sluggish demand growth and then in 2020, global recession caused by virus pandemic and leveraged financial system ought to provide new challenges for respondent companies. Are these only signifying the current findings and development trends of 2012-2018 surveys, or are challenges multi-faced? Another avenue for further research would be to examine demand management (forecasting and planning) and purchasing through company case studies, and trying to sketch best practices in the current business environment.

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