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Scenario Planning in Supply Chain Management

Bachelor's thesis

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This thesis presents a summary of the academic literature on scenario planning, and more specifically looks at the available literature on scenario planning from a supply chain management perspective, aiming to answer the research question: what does scenario planning look like in the context of supply chain management.

Scenario planning is a strategic decision making process, where organizations aim to prepare for uncertainty in the future by developing a range of alternative futures and signposts that may indicate a development of the operational environment towards that future.

In the context of supply chain management, scenario planning is quite fast paced and short-term oriented, contrasted with the more long-term planning perspective associated generally with scenario planning. This is achieved partly through digitalization and the introduction of collaborative scenario planning, where organizations work together with outside stakeholders to share information.

Key words: scenario planning, scenario analysis, supply chain, supply chain management, supply chain uncertainty

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1 Introduction

1.1 Background & definitions

Global supply chains have encountered multiple highly impactful events in recent years, such as the Covid 19 pandemic, Russia's attack on Ukraine and more recently the attacks on global shipping in the Red Sea. These low probability, but high impact events can be potentially catastrophic for companies, as their risk is difficult to quantify making them difficult, if not impossible to prepare for. Because of this they can leave even established companies potentially exposed and unprepared to deal with them (Simchi-Levi & al. 2014:97) Companies must therefore find ways to deal with this kind of uncertainty in their supply chains.

One of the methods for dealing with high impact and low probability events discussed in academic literature is scenario planning, a strategic decision-making process through which organisations work to come up with a range of possible futures they might face. These futures are called *scenarios.* (Wade 2010:9)Van der Heijden argues that the core purpose of scenario planning is to help create an organisation that is more adaptable and can use creativity to its advantage. (Van der Heijden 2005:5) Ultimately, scenario planning aims to help organizations better prepare for unprecedented changes in their operational environment. The scenarios that result from scenario planning should be memorable, coherent stories describing a small set of possible future operating environments and how they might come about. (Ramirez et al. 2014:255)

Perhaps the best way to understand how the academic literature defines scenario planning is to consider what scenario planning is not. Ramirez underlines that scenario planning and the resulting future scenarios are never predictions or projections based on past data and events. While using past data to predict the future is the conventional method organisations often use to plan ahead, this method is only viable if the operating environment of the company remains unchanged into the future. When operating environments fundamentally change, forecasting based on past data becomes impossible. (Wade 2010:10) This is where scenario-based decision making comes in.

1.2 Research aim

This thesis takes the conventional literature on scenario planning and applies it to the context of supply chain management, aiming to explore how scenario planning, which is often considered to be a decision-making tool considering overall strategy, is used by supply chain professionals on a more practical level. The literature combining the two remains quite limited and thus should be explored more. The research question is as follows: “What does scenario planning look like in the context of supply chain management?”

My interest in the subject was spurred by the events occurring in the Red Sea in late 2023, when Houthi rebels began attacking cargo ships with missiles. The events were unprecedented in the history of the Suez canal, which is a key shipping route between Europe and the Far-East. As a procurement professional, I became interested in researching methods that could be used to plan for such high impact and low probability events that have the potential to massively disrupt supply chains.

1.3 Thesis structure

The thesis follows the structure of a literature review, focusing on the relevant literature on scenario planning and it’s applicability to supply chain management. Following the introduction, the second chapter discusses supply chains and uncertainty, focusing especially on the kind of uncertainty which is difficult to prepare for. The third chapter reviews the theory on scenario planning and discusses how it can be used as a tool for managing an uncertain future. This is presented through the framework of the 2x2 scenario matrix, which is the most common way of conducting scenario planning according to the cited literature. The fourth chapter explore what scenario planning looks like in the context of supply chain management, delving into how scenarios can be applied at different levels of decision-making in supply chain management, in order to better deal with uncertain futures. The final and fifth chapter contains a summary and conclusions.

2 Supply chains and uncertainty

Global supply chains have encountered many low probability, high impact events in recent years. Examples such as the Covid-19 pandemic, Russia's attack on Ukraine and the growing conflict in the Red Sea have greatly impacted supply chains worldwide. Traditional methods for managing supply chain risk are ineffective when such events occur, since conventional supply chain risk management often relies on estimating probabilities for disruptions. (Simchi-Levi et al 2014:97) The likelihood of every-day supply chain disruptions such as temporary stock-outs and transport breakdowns can be relatively accurately modelled based on historical data, but it would have been nigh impossible to quantify the probability of events such as the container ship Ever Given getting stuck in the Suez canal. This is due to a lack of relevant historical data and extremely low likelihood of such an event. Additionally, statistical methods of supply chain risk management also fail to consider factors like the appearance of new and disruptive competitors and emerging technologies that fundamentally change the nature of an organisation's competitive environment. (Wade 2010:12)

Shardul et al (2020. divide the supply chain roles of organizations into three categories: the functional role, the business model role, and the infrastructural role. Organizations in the functional role operate supply chains as a core part of their overall business, for example manufacturing companies must consider the distribution and delivery of finished goods as well as the inbound procurement of raw materials involved in the production process. For organizations in the business role, supply chains and their management are essentially their whole business. These include 3PL logistics providers and freight forwarding companies. Lastly organizations in the infrastructural role include governments and their contractors who are tasked with the maintenance and creation of the infrastructure on which supply chains run. These include for example ports and cargo terminals as well as highway infrastructure for road transport. (Shardul et al 2022: 20-21).Organizations in all three of these categories are affected by the aforementioned high impact, low probability events and when considering the future. Since the future is unpredictable and ever changing, it is here where scenarios and the practice of scenario planning can be applied to the benefit of supply chain management.

Preparing for supply chain uncertainty is also often overlooked by organizations, and if supply chain risk management is conducted, it often focuses on the wrong points in the

supply chain. Simchi-levy et al (2014:97) found that there is little correlation between the amount of money that companies spend on procurement at a particular site and the impact that a disruption at that site would have on the company's overall operations. This suggests that companies are potentially unaware of weaknesses in their supply chains, especially from the point of view of low probability and high impact events. Preparing for supply chain uncertainty is important and good preparation can lead to a competitive advantage. For example, in 2021 global automaker Toyota was able to avoid the semiconductor chip shortage faced by most automakers, which occurred as a result of supply and demand shocks caused by the Covid-19 pandemic. Toyota managed this because as result of the 2011 Fukushima earthquake and subsequent tsunami, they had identified that their semiconductor manufacturers were particularly vulnerable to high impact, low probability events. This insight caused Toyota to divert from their famous lean-production model, and begin stock-piling several months' worth of semiconductor chips early during the Covid-19 pandemic. Toyota management had previously learned, that when sudden unpredictable events affect semiconductor suppliers, their lead times become very long. (Shardul et al 2022: 1-2) Thus, they successfully judged the risk to production posed by the Covid-19 pandemic, and acted in advance.

3 Scenario planning as a tool for managing uncertain futures

3.1 Generating scenarios

In practise, scenario planning is typically conducted via brainstorming workshops, bringing together a variety of different perspectives from withing an organisation. (Wade 2010: 42) An alternative to brainstorming is the interview-based method, where an external scenario planner interviews participants individually, aiming to trigger the participants into articulating their views on the organisation's future. (Van der Heijden 2005:168) Whichever the method, the core purpose of. Scenario planning is to create an environment that fosters creativity and discussion on the future of the organisation conducting the planning exercise, Disagreement among the participants is encouraged and even deemed necessary, since this helps prevent a situation where the scenario planners come up with a 'preferred future' or 'best/worst' scenario. This is dangerous, as it may skew decision making towards the 'preferred future', even though there is no guarantee that the scenario is any more likely to occur than the less desirable scenarios. (Ramírez et al 2013: 836)

The most commonly used method for visualizing the results of a scenario planning session is a 2x2 scenario matrix with two axes determined during the planning process. Both axes represent potential changes in the future of an organisation, and the change can either be positive or negative. This leads to the emergence of four different future scenarios in the grid. A 2x2 scenario matrix is especially useful in situations involving considerably high uncertainty (Van der Heijden 2005: 247) the 2x2 scenario matrix is considered by literature to be the standard method for scenario planning (Ramirez et al 2014: 244)

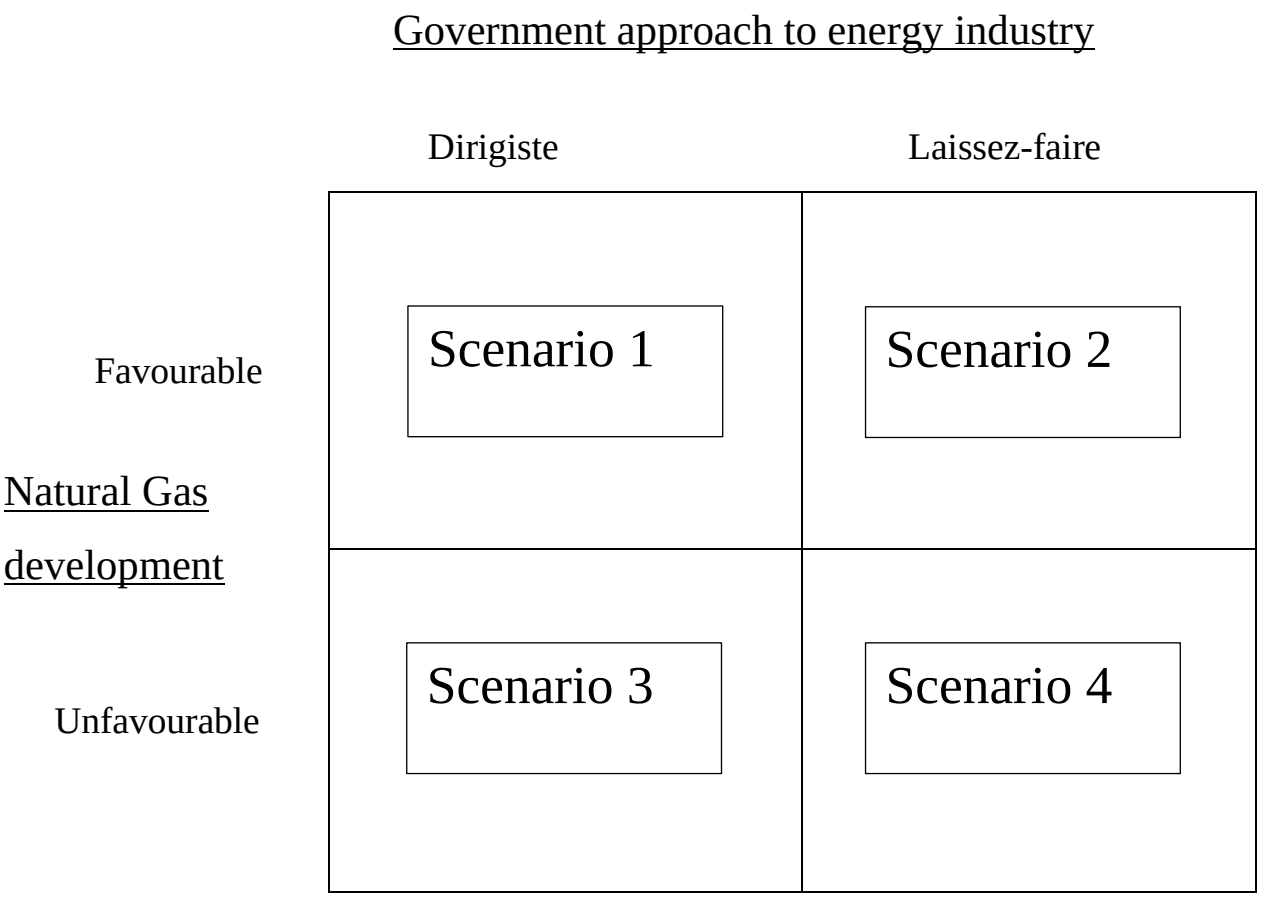

Figure 1: A 2x2 scenario matrix about the future of a natural gas company

The figure above from van der Heijden's *Scenarios* and shows an example of what a scenario matrix might look like for a natural gas company. Ideally, the company would prefer for scenario 2 to materialise. In this situation, both the regulatory environment as well as the competitive and technological environment for the natural gas industry remain favourable to the company. However, any one of the four scenarios could materialize, and aspects such as the local government's approach to regulating the energy industry are beyond the control of the company. The company must therefore prepare an action plan for any of the scenarios.

3.2 Tracking scenarios and identifying signposts

Once the scenarios have materialised, an organisation should come up with a system to track the scenarios. Wade (2010:53), suggests the use of signals, which are milestones or certain events that are identified as possible indicators that a certain previously

identified scenario is possibly starting to take place. This should then prompt management to act according to their plan for that certain scenario taking place. Monitoring scenarios and correctly identifying signposts is crucial to scenario planning, and also contains risks, if signposts are misjudged. Ramirez et al (2013:479-481) divides the abstract future into three different classes: tame futures, wild futures, and feral futures. In tame futures past data remains useful and forecasting works. This means that the operating environment continues to work predictably in the same way it has thus far. Wild futures on the other hand, are defined as futures where the operating environment significantly changes, for example when a high impact, but low probability event occurs. These are the type of situations that scenario planning aims to prepare organisations for. The third situation, ‘feral futures’, is when a previously mentioned wild future-situation is mistaken for a tame future-situation, and the regular methods to deal with tame situations are mistakenly applied to the situation, making it worse as a result. (Ramirez et al 2013:478.) Proper management and tracking of scenarios is thus needed, so that the right action plan can be applied in time. The benefit of conducting scenario planning will be quite limited, if management fail to interpret signposts correctly.

4 Scenario planning in the context of supply chain management

Joglekar and Phadnis (2021:72-76) refer to developments such as the UK's 2016 decision to leave the European Union as well as the weakening of U.S-China trade relations which began in 2017 as catalysts that have triggered increased interest in scenario planning in the context of supply chain management. The distinguishing factor in this new interest in scenario planning is that this type of scenario planning is conducted with time horizons of a few weeks, instead of the more long term view that traditional scenario planners take. (Joglekar & Phadnis 2021: 72-76) This lays the groundwork for this chapter, which takes a look at what scenario planning looks like in supply chain management, where decision making is arguably much more practical and operational, compared to the conventional scenario planning literature, which focuses mainly on strategic long-term planning.

4.1 The role of scenario planning in supply chain management.

An example of the use of practical scenarios in supply chain management is provided by (Simchi Levy et al. 2014:100-101), where Ford Motor company management was presented with the following two potential scenarios: In the first scenario, Ford's key supplier faces a two week production halt at their factory, and in the second scenario, the production halt is stretched to eight weeks. (Simchi-Levy et al. 2014: p.101-102) This is a great example of how scenarios can be used on a practical operational level to consider supply chain risks. It also illustrates how a single scenario such as a sudden halt of production at a supplier's facility can be adjusted for various degrees of severity. A company may be capable of easily surviving a two-week supply disruption, but eight weeks may be a stretch too far. This example also supports the argument by Ramirez, in which he argues that the 2x2 scenario matrix is not only a tool for presenting "either-or" situations, but instead one that can be fine-tuned to consider "less-more" situations with varying degrees of severity (Ramirez et al 2014:257). Thus the 2x2 grid is deceptively simple at a glance, but can be used to model even complex situations in great detail. This explains to some degree the popularity of the method among scenario planners. Having identified the practical nature of supply chain scenario planning, it is important to look at some of key drivers enabling this fast paced scenario planning to take place, without compromising the quality and usefulness of the resultant scenarios. Joglekar

and Phadnis (2021:72-76) refer to digitalization and collaborative planning as those drivers. Collaborative supply chain scenario planning is, where organizations conduct scenario planning together with their suppliers through the sharing of information horizontally and laterally across supply chains (Joglekar and Phadnis 2021:72-76). This is somewhat of a new perspective on the subject when compared to most literature, where supplier relationships tend to be viewed more as possible risks in the scenarios, instead of opportunities, like in the case of Toyota's semiconductor chip scenario referenced earlier. However, the value of collaborative planning is not limited to a traditional buyer-supplier relationship. It can also be applied to collaboration between different business units or functional units within the same organization. (Joglekar and Phadnis 2021:72-76) Especially multinational companies with global supply chains can benefit from applying collaborative supply chain scenario planning.
One of the important benefits of collaborative planning is that in addition to accelerating the pace of scenario planning, it was found to greatly reduce the risk of bias in the scenario planning process (Joglekar & Phadnis 2021:72-76). Since futures are always uncertain, scenario planning in general is always subjective to some degree, and all of the literature on scenario planning emphasizes the importance of encouraging disagreement and discussion with varying perspectives. However, it could be argued that the range of perspectives found from within a single organization are somewhat limited, as they all work to benefit the interests of their organization, in their respective ways. Collaboration with another organization with different interests can thus reveal some overlooked weaknesses.

Supply chain professionals are also able to conduct scenario planning on multiple different levels of decision making in an organization. For example a supply chain director may consult top management on their supply chain concerns as a part of their long term strategic scenario planning process, while also applying scenarios on a more practical level when managing more operational aspects of the organization's supply chain. This is supported by the consensus across scenario planning literature that a wide range of perspectives should be encouraged in the scenario planning process. Thus, even though most of the literature views supply chain scenario planning as practical and short-term, the insights of supply chain professionals can also be beneficial from a more general long term strategic planning perspective.

5 Conclusion

Overall, Scenario planning is increasingly becoming a more widely used practice in supply chain management, and much of it's potential in the field may still be underutilized. This is evident from the fact that most of the major literature on the subject has been written post-Covid 19 pandemic, which is also cited by literature as a turning point for global interest in supply chain scenario planning. Potential benefits of scenario planning are evident, especially when it comes to dealing with high impact, low probability events, as existing methods for dealing with these remain limited. Modern scenario planning in the context of supply chain management benefits from digitalization and the introduction of collaborative scenario planning across and up supply chains. This has allowed supply chain scenario planning to shorten the planning time-frame for the scenarios, while still maintaining the quality of the scenarios.

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