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Transport and Logistics in the Baltic Sea Region by 2030

A Foresight Study

Eeli Friman

Lauri Ojala

Harri Lorentz

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Keywords: Baltic Sea Region, Futures Studies, Transport, Logistics, PESTE, Delphi

Abstract:

The aim of this thesis was to map the outlook for transport and logistics in the Baltic Sea Region by the year 2030. The study was assigned by the Interreg Baltic Sea Region Programme's HAZARD project as a follow-up to previous research by Ojala et al. (2013) and the graduate thesis by Leino (2014).

The data was gathered using the Delphi method by surveying a multinational expert panel of 96 participants from the Baltic Sea Region. The survey included 52 questions subdivided into 10 themes. Several factors anticipated to affect the region's competitiveness by 2030 were identified, of which the most important were the following: the growing importance of environmental aspects, significant technological advances, increasing taxation and regulation, increasing prevalence of cyberthreats, and a shortage of skilled blue-collar labour. Differences from the findings of the preceding Delphi study were minor. The greatest change was related to the tightening of border controls between EU countries and countries outside the Union. This was anticipated to intensify further and more clearly than in the previous study.

In response to the findings, the following policy recommendations are made for decision-makers: logistics aspects should be researched more thoroughly when making decisions; equipment and infrastructure should be prepared for tightening environmental regulation; the logistics sector should brace for tax and regulatory changes affecting profitability; technological changes must be planned for to enable the effective adoption of relevant innovations; the approaching lack of a skilled workforce should be prepared for by investing in relevant education; cybersecurity needs to be increased across all parts of the supply chain; and possible alternative trade relations should be considered in order to prepare for the anticipated tightening of border crossings between Russia and other Baltic Sea Region countries.

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ResQU2 Platform Project is an Interreg BSR Flagship Project from October 2018–September 2020 with a budget of 1 million euros. ResQU2 stands for "Enhancing the durability of learning experiences gained in ChemSAR, HAZARD, DiveSmart Baltic and Mirg-Ex projects on guidelines, operational plans and procedures and exercises related to incidents at sea and in ports".

The objective of ResQU2 is to increase rescue authorities' and services' preparedness and reduce the effects of possible large-scale incidents at sea or in ports. ResQU2 will ensure that the learning experiences gained from the aforementioned four projects and existing guidelines are communicated, discussed and demonstrated to the national rescue authorities around the Baltic and North Sea areas.

Table of contents

List of Figures

List of Tables

List of abbreviations

ADR	Age Dependency Ratio
AI	Artificial Intelligence
BDA	Big Data Analytics
BDF	Baltic Development Forum
BI	Business Intelligence
BSR	Baltic Sea Region
BSR^{-1}	Baltic Sea Region without Belarus
CBSS	Council of the Baltic Sea States
CIA	Central Intelligence Agency
CPI	Corruption Perceptions Index
DWT	Dead Weight Tonnage
EEA	European Economic Area
EU	European Union
EUSBSR	European Union's Macro Regional Strategy for the Baltic Sea Region
GCI	Global Competitiveness Index
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GII	Global Innovation Index
ICAO	International Civil Aviation Organization
ICT	Information and Communication Technology
IMF	International Monetary Fund
IMO	International Maritime Organization
IoT	Internet of Things
IRU	International Road Transport Union
LPI	Logistics Performance Index
LSCI	Liner Shipping Connectivity Index
NATO	North Atlantic Treaty Organization
NUTS	Nomenclature of Territorial Units
OECD	Organization for Economic Co-operation and Development
OSJD	Organization for Co-operation Between Railways
OTIF	Intergovernmental Organization for International Carriage by Rail
PESTE	Political, Economic, Social, Technological and Environmental
PPP	Purchasing Power Parity
PSSA	Particularly Sensitive Sea Areas
PWC	PricewaterhouseCoopers
R&D	Research and Development
RCI	Regional Competitiveness Index
RFID	Radio Frequency Identification

T&L	Transport and Logistics
TEN-T	Trans-European Transport Network
TEU	Twenty Foot Equivalent Unit
UN	United Nations
WEF	World Economic Forum
WHO	World Health Organization
WMRD	Warsaw Ministry of Regional Development
WTO	World Trade Organization

1 INTRODUCTION

"Change is the law of life. And those who look only to the past or the present are certain to miss the future." – *John F. Kennedy*

As the former President of the United States recognised, change is inevitable and the future cannot be dismissed. The future, and the changes it may bring, are the topics of this thesis—more specifically the state of transport and logistics (T&L) in the Baltic Sea Region (BSR[-11]) by the year 2030. The aim is not, however, to create a specific scenario set in a single point of time, but to identify what winds of development could be blowing between now and 2030.

Like weather forecasts, those for T&L are not exact; situations can change unexpectedly and fast. Forecasting is more about creating an array of possibilities and estimating the likelihood of events than stating with certainty that something is going to happen. In this thesis, rather than estimating whether one will need an umbrella tomorrow, we assess what sort of storms the T&L industry is expected to weather in the coming years. The ultimate goal is to provide useful insights for policymakers based on the results of this study.

1.1 Background and purpose of the study

T&L is a volatile industry, upon which technological advances often have significant effects. A cheaper and faster method for transporting people and goods will quickly put older methods out of use. For example, the advent of the railroad in early 19th century, the airplane in the early 20th and the sea container in 1956 has in each case revolutionised transportation as people knew it (Grazia Speranza, 2018). Political changes have significant effects on the industry as well, as one country restricting its trade or closing its borders partly or entirely can force the supply chain to either make major changes in purchasing strategies, switch to another transportation method or route, or even find an entirely new business partner. A systematic consideration of the future is critical for avoiding such setbacks and developing successful logistics; hence companies that neglect planning for the future will miss opportunities and face higher risks than those that are actively engaged in futures studies (Melnyk et al., 2009; Singh, 2004).

One can easily imagine the success of a company that would have predicted the container revolution before it happened. However, predicting the future is by no means an easy feat. It is difficult to consider and prepare for every possibility that the future may bring. The focus is typically on things that are likely to happen, but nothing that could have major consequences should be completely ignored. It is hence vital to think of the possible as well, not just the probable (PWC, 2011).

This thesis will focus on both the possible and probable future changes affecting the T&L sector in the BSR[-1]. The BSR[-1] is a particularly interesting area, as it comprises highly diverse countries from political and economic as well as transport and logistics points of view. The companies in the BSR[-1] have access to roughly 100 million consumers and easy access to other European countries outside the region (CIA, 2018). This leads to busy trade routes with high transportation volumes. This study provides a comprehensive outlook on this complex region and an interesting

[1] Interreg's definition of the Baltic Sea Region with Belarus removed.

possibility to compare our foresight with previous ones, allowing the stability of such forecasts to be evaluated in terms of how radically our expectations of the future have changed.

1.2 Research question and limitations

The research question of the thesis is *what are the possible and probable futures of transport and logistics in the BSR^{-1} by the year 2030?* We aim to answer this by addressing the following research questions:

- What is the state of transport and logistics in the Baltic Sea Region in 2019?
- What are the expected changes in the state of transport and logistics by the year 2030?
- How does the foresight on transport and logistics in the Baltic Sea Region in 2030 conducted in this thesis differ from a similar foresight for the year 2025?

It should be noted that the aim of studies of this sort is to provide information for policymakers to take strategic decisions by understanding how the BSR^{-1} will possibly develop in the coming years, and not to create an absolute prediction of what the future looks like in 2030. This research continues where previous research by Ojala et al. (2013) and a graduate thesis by Leino (2014) left off. Both of those studies focus on the state of T&L in the BSR^{-1} in 2025. Additionally, both use the Delphi method with mostly similar questionnaires. Hence, this study was limited to the Delphi method for gathering data from the expert panel to keep the comparability of the results as close as possible. The questionnaire is restricted to the same prevailing themes and was simply updated by removing an already resolved question and adding a few new topics considered pertinent to the research.

1.3 Key definitions

This thesis revolves around three major themes: transport and logistics, futures studies and the Baltic Sea Region. The said concepts emerge often in this work and defining them distinctly is crucial for the intelligibility of the research.

1.3.1 Transport and logistics

T&L plays a big role in our everyday lives, with only 30% of any final products containing local input (WEF, 2012), which even then needs to be moved efficiently from the manufacturer all the way to the retailer and end user. Despite its importance, the concept of T&L is not clear to many. According to Mukherjee and Miglani (2010), the definition of T&L has changed over time, but generally the broader concept covers all transportation forms and refers to infrastructure such as highways and other roads, railways, airports and ports. Services and infrastructure such as warehousing are associated with T&L as well. In addition to physical transactions and infrastructure, the concept also refers to planning and controlling the flow of goods and information efficiently.

Hesse and Rodrigue (2004) argue that T&L comprises two major functions: Physical distribution and materials management. Physical distribution includes all the activities necessary to

transport a product from the place of production to the point of sale or consumption. The activities regarding movement of goods include ways of transportation (inland waterways, pipelines, and road-, rail-, air- and maritime freight), transshipment and warehousing (consignment, storage, management of inventories), trade and wholesale. In principle they include retail as well.

The second function of T&L is materials management. It is everything related to the manufacturing of goods at every stage of the supply chain. It comprises production and marketing functions (production planning, demand forecasting, purchasing and inventory management). It is also responsible for ensuring that the needs of the supply chain are met by having enough raw materials at all times, including packaging materials and recycling. Basically, materials management should correspond to the demands of physical distribution at all times.

Therefore, T&L does not only mean the movement of goods from point A to point B but includes a wide array of different functions. In the same way, this thesis does not focus solely on the transportation aspect but aims to take all these functions into account when drawing its conclusions.

1.3.2 Futures studies

This thesis is in its essence a futures study. Futures studies, also known as futures research or futurology, aims to understand and evaluate possible and probable future outcomes in a determined setting. It is an unusual way of research in the sense that the researched topic does not yet exist, at least not in the conventional sense of existence. However, according to Slaughter (1998), the future is a vital component when making decisions in the present, and even though it cannot be predicted with pinpoint precision, it can be understood, mapped and created.

Glenn (2009) argues that because of the uncertainty of the research, futures studies is not a science. This is considered a controversial statement in the literature, for example by Golkarl et al. (2017). Nevertheless, it is extremely dependent on the conductor of the research and on the methods used. Different settings require different approaches, and a clear conclusion of which method is best is challenging to make. This gives the researcher some degree of artistic freedom in the selection of techniques.

Even though it is not widely accepted as a science in the conventional sense, futures studies has gained popularity and kindled the interest of technological, political and social scientists, among others, as its usefulness has become better understood (Glenn, 2009). The common purpose of futures studies is to help policymakers take decisions by providing them with information on possible upcoming changes and related risks and opportunities.

The word “futures” is in plural form because the aim is not to find one correct answer but multiple possible and probable futures. The focus of futures research differs depending on the purpose of the study, and for example in financial investment the goal might be to find just the one most probable future. However, in safety and security related projects such as HAZARD, it is important to understand all or most of the different possible scenarios that could take place, and preparing for just one probable scenario is not enough. (Rowland & Spaniol, 2015.)

1.3.3 The Baltic Sea Region

The BSR[-1], our area of research here, is defined in various ways depending on the scope of the research (e.g. political, economic, social or geographical, to name but a few). It has no permanent boundaries but instead comprises multiple overlapping regions (Götz, 2016). For this reason, it is important to clarify what the definition means and which countries the region comprises in this thesis. The EU's Interreg Baltic Sea Region Programme 2014–2020 defines the region as including the following countries: Sweden, Poland, Norway, Lithuania, Latvia, Finland, Estonia, Denmark, Belarus and parts of Germany and Russia (Interreg Baltic Sea Region, 2018). The region is illustrated in Figure 1.

Figure 1 The Baltic Sea Region as determined in this thesis, with Belarus excluded from the definition (modified from Interreg Baltic Sea Region, 2018)

However, because the focus of the HAZARD project is port and maritime safety, we ruled out Belarus from the BSR[-1] definition in this thesis, as it does not have any coastline or ports along the Baltic Sea. Additionally, various "freedom indices" have criticised the political conditions in the country and the reliability of the available data. Freedom House lists Belarus among the countries that are not free in 2018, based on evaluation of e.g. the electoral process,

government functioning, freedom of speech, law and individual rights (Freedom in the World, 2018). Reporters Sans Frontières (RSF) lists multiple problems regarding free press and information. It reports that more than 100 journalists were arrested in Belarus in 2017, that foreign media representatives are having difficulties operating in the country, and that although independent newspapers can again operate, internet censorship has increased noticeably (RSF, 2018). Hence, the definition of the BSR^{-1} in this thesis includes the following countries:

- Denmark
- Estonia
- Finland
- Northern Germany
- Latvia
- Lithuania
- Norway
- Poland
- North-West Russia
- Sweden

More precisely, northern Germany comprises the federal states of Berlin, Brandenburg, Bremen, Hamburg, Mecklenburg-Vorpommern, Schleswig-Holstein and Niedersachsen (only NUTS II area Lüneburg region). The parts of Russia included in the BSR^{-1} definition here are the following: St. Petersburg, Arkhangelsk Oblast, Vologda Oblast, Kaliningrad Oblast, Republic of Karelia, Komi Republic, Leningrad Oblast, Murmansk Oblast, Nenetsky Autonomous Okrug, Novgorod Oblast and Pskov Oblast. (Interreg Baltic Sea Region, 2018.) As the areas of Germany and Russia are not included in their entirety in the definition of BSR^{-1}, neither are the populations. The populations as defined in this thesis are illustrated in Table 1.

Table 1 Population of Germany and Russia as defined in this thesis (Citypopulation, 2018a; Citypopulation, 2018b; Eurostat, 2018; GKS, 2018)

Country	Baltic Sea Subregions	Population estimate 2017-2018 (million)	Nominal GDP estimate 2016 (bn USD)
Entire Germany		**80.59**	**3 478.00**
Baltic Sea Regions of Germany	Berlin	3.61	129.92
	Brandenburg	2.50	68.76
	Bremen	0.68	32.38
	Hamburg	1.83	111.08
	Mecklenburg-Vorpommnen	1.61	41.58
	Schleswig-Holstein	2.89	89.55
	Niedersachsen*	0.18	46.43
	Total	**13.30**	**519.69**
Regions in respect to entire Germany		**17%**	**15%**
Entire Russia		**142.26**	**1 259.10**
Baltic Sea Regions of Russia	St. Petersburg	5.35	68.00
	Arkhangelsk Oblast	1.16	7.78
	Vologda Oblast	1.18	8.84
	Kaliningrad Oblast	0.99	6.97
	Republic of Karelia	0.62	4.24
	Komi Republic	0.84	9.94
	Leningrad Oblast	1.81	16.60
	Murmansk Oblast	0.75	5.97
	Nenetsky Autonomous Okrug	0.04	4.65
	Novgorod Oblast	0.61	4.45
	Pskov Oblast	0.64	2.63
	Total	**13.99**	**140.06**
Regions in respect to entire Russia		**10%**	**11%**

*Only Lüneburg region of the Nomenclature of Territorial Units for Statistics (NUTS) 2 level

Various values were used in this thesis to illustrate, for example, the economic or political situation of the BSR^{-1}. As Germany and Russia are included only partly here, an appropriate weighting was required for the values on several occasions. Including these large powers in their entirety would certainly twist the results, leading to unnatural outcomes. The weighting was done by putting the population and the gross domestic product (GDP) allocated to the area included in the BSR^{-1} definition in direct proportion to the population and GDP of the entire country as follows:

$$\text{Weighting of the country} = (x^1 / x^2 + y^1 / y^2) / 2$$

In the equation, x^1 signifies the population of the BSR^{-1} regions of the country, x^2 the entire population of the country, y^1 the GDP of the BSR^{-1} regions of the country, and y^2 the GDP of the entire country. Hence, the respective weightings of the countries are the following:

$$\text{Weighting for Germany} = (13\,313\,021 / 80\,594\,017 + 519.7 / 3\,478.0) / 2 = 0.157$$

$$\text{Weighting for Russia} = (13\,996\,000 / 142\,257\,519 + 140.1 / 1\,259.1) / 2 = 0.105$$

Certain values in the tables and figures for the whole of Germany have been multiplied by 0.157 and for Russia by 0.105. The weighted numbers are marked with an asterisk. Percentual

numbers or indices such as the Logistics Performance Index (LPI) or Global Competitiveness Index (GCI) are not weighted. However, it should be noted that the large economic structure of the two aforesaid countries in their entirety affect the workings of the defined regions despite the use of weighting in the values.

1.4 Structure of the thesis

The topic of this research comprises three themes: Futures research, the BSR^{-1} and the T&L sector. The futures study conducted in this thesis utilises futures scanning in the form of a literature review of the T&L sector, categorised with the help of PESTE analysis. The empiric study was conducted with the Delphi method, with the questionnaire built upon the findings from the literature review.

The thesis commences with the introduction, followed by a literature review of futures studies. It then conducts a futures scanning in the form of a literature review of the current and future state of the BSR^{-1}, arranged in subcategories according to the PESTE (political, economic, social, technological, environmental) themes. This is followed by reviewing the literature on the T&L sector of the BSR^{-1}. The thesis then continues to the methodology and structure of the Delphi study, with the results viewed in the following chapter. Finally, the thesis discusses the findings of the study and summarises the conclusions.

2 RESEARCHING FUTURES

Humans throughout history have always had a keen interest in knowing the future, for example through prophecies. Conventional ideas that come to mind include the prophets of the Bible or the oracle of Delphi, but here we focus on concepts such as futures scanning and the Delphi method. We may not be able to deliver prophecies in the way that fortune-tellers do at fairs, but we can understand and map out the future to a degree in a scientific manner, and the methods for doing so are many.

2.1 Futures research methods

As futures studies is not a conventional science and does not rely on any adamant theories, the scope of research can be quite wide and the methods of research are not rigorously defined. There are various techniques for estimating the possible futures regarding large systems. Aaltonen and Barth (2005) argue that different methods have different strengths. For this reason, a crucial part of futures study is choosing the appropriate method or methods for the research. Maness (2012) argues that the most commonly used methods include, to name but a few, the Delphi method, futures scanning, scenario planning, cross-impact analysis, simulation and modelling, and trend analysis.

The methods mentioned above are large frameworks for carrying out futures studies, and characteristics of many of them can be found in this research. However, our focus is on two methods, which are discussed further in Chapters 2.3 and 2.4:

- Futures scanning
- Delphi method

Futures scanning is a broad method, or collection of methods, for understanding a studied topic and its possible and probable futures. In this thesis it consists of literature reviews. The Delphi method was used in this thesis to gather empirical data from a survey of a panel of experts. The questionnaire of the Delphi survey was refined using the findings that emerged from the futures scanning.

A reader with good knowledge of futures research might wonder why, for example, the cross-impact analysis commonly used with Delphi is absent in this research. The method would provide valuable information on how future events intertwine. However, as the time and the scope of this research were limited, many methods were left out. Additionally, with the 52 questions in the Delphi survey, a matrix with 2 652 judgments (52 x 52 – 52) would have been needed for conducting a cross-impact analysis. In addition, the weighting of how the events affect one another requires advanced expertise on all of the researched topics beyond the current capability of the researcher. Hence, as this research aims to provide useful results with high accuracy, only the methods that could be utilised efficiently were prioritised. (Glenn, 2009.)

2.1.1 Scenarios

Scenarios are a tool in futures studies commonly used in business intelligence (BI) as well as in governmental- and military planning, with the purpose to aid leaders in their decision making. A scenario can be defined as a rich and detailed portrait of a future world, with assumptions made about different phenomena with estimated probabilities. It should be clear enough for the planner to vividly identify and comprehend problems, challenges and opportunities present in the world described by the scenario. (Golkarl et al., 2017; Maness, 2012.)

Gordon et al. (2005) use mathematical models as an example to describe the development of scenarios, and state that most research in futures use linear assumptions. The benefit of making a linear assumption is that linear equations are easier to construct and hence better suited to mathematics. In simpler operational regions, linear models may even be a good match for reality. However, most real-life physical and social systems are nonlinear. The linear system may either be stable, oscillate or be unstable, while the nonlinear system may be chaotic[2]. Large concepts such as the BSR^{-1} will behave in a chaotic way almost without exception while observed as a single entity.

In the policy sciences, one way to identify the optimal policy is to test them on models simulating the real world. In these simulations it can be noticed that if the model, and hence the real system, is in a chaotic state, the results of the policy test may be altered by large factors that were not accounted for. In successive runs of the same model, quite differing results may be obtained, with only very slightly different conditions in the simulation. The history is not a reliable guide for predicting the future outcomes if the system is in a chaotic state. Hence, the researcher should be careful while estimating the shifts in the system under study, as even a small and seemingly irrelevant event could lead to substantial change. (Gordon et al. 2005.)

As an example, we could consider the prevailing situation as the starting point and the forecasted situation as the endpoint in the coordinate system of futures. The predicted outcome is that the current situation leads to expected endpoint A with the events we are aware of—ergo, without any external unpredicted phenomena, future A would happen. However, in futures research it is usually expected that unpredicted phenomena will occur, warping the trajectory and leading to a future that resembles the expected future A but does not match it entirely. Let us call this unknown future B. The difference between futures A and B depends on the significance and number of unpredicted phenomena. This is illustrated simplistically in Figure 2.

[2] Somewhat deterministic, but essentially unpredictable (Gordon et al., 2005).

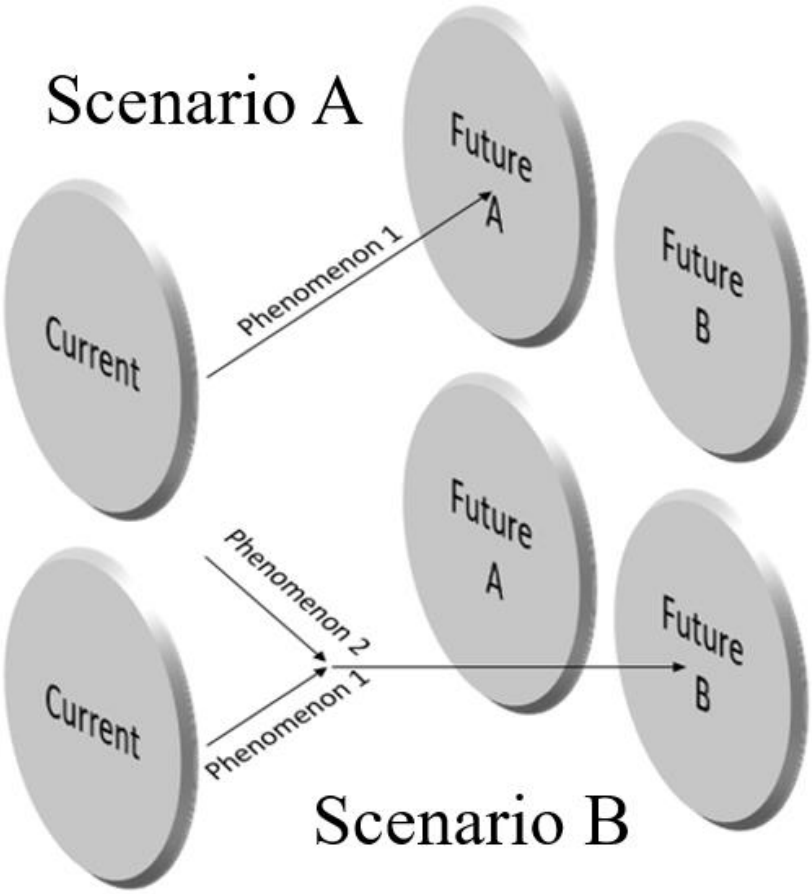

Figure 2 Development of different scenarios

In Figure 2, Scenario A is the expected one. Phenomenon 1 is expected to happen, changing the current state of things and leading to future A. In scenario B, the expected phenomenon 1 is affected by unexpected phenomenon 2, which warps the trajectory of the futures and leads to an unpredicted future B.

2.1.2 Futures scanning

Futures scanning (also known as early warning systems, environmental scanning systems or futures intelligence systems) takes place typically at the beginning of a futures study (Gordon & Glenn, 2009). The purpose is to gain a broad understanding of major trends, issues, advancements, events and ideas across a wide range of activities, and understand which parts will most likely see change in the future. The information should be gathered from multiple sources to provide as comprehensive and reliable a view as possible. Typically, the scanning is done on a macro level. In this thesis, a large-scale scanning of the BSR^{-1} is conducted first, followed by more specific scanning of the T&L sector. (Maness, 2012.)

As discussed in the previous subchapter, the myriad of factors that affect the futures of complex and large entities leads to chaotic and unpredicted behaviour. This leaves plenty of room for error while attempting to conduct a futures scanning. However, most of the time the complex models may be reduced to smaller entities to simulate real systems operating in stable mode. These modes may then be used to find the factors that cause the systems to succumb to a

chaotic state. For example, development of supply chains can be forecasted more efficiently if they are not looked at as a single construct, but as comprising different functions such as purchasing, warehousing and transportation. If this is done successfully, the alternative outcomes become more understandable and the bizarre behaviour might not be as random as it first seems. (Ehresmann, 2013.)

As subcategories can help to recognise the linear and more stable patterns, a framework to break down the researched topic into manageable pieces is recommended. Such a way of conducting futures scanning may take on various forms, but in this thesis a PESTE analysis is used to organise the literature review conducted regarding the T&L of the BSR^{-1}. The PESTE analysis is discussed in greater detail in Chapter 4.1. (Gordon et al., 2005.)

Gordon and Glenn (2009) argue that some of the most popular ways of conducting futures scanning are literature reviews and expert panels, of which both are used here. A literature review of the T&L sector of the BSR^{-1} was carried out using the PESTE as a structure, followed by distributing a survey to a panel of BSR^{-1} logistics experts. Other methods for futures scanning are, for example, Google alerts and key person tracking, which serve as a powerful tool for constant scanning, and even though they not utilised in this research, they can be very beneficial, for example, for companies following certain trends.

2.1.3 The Delphi method

The name Delphi derives from an ancient Greek oracle who was said to be able to predict the future. In today's futures studies the magic has faded but the purpose remains, which is the attempt to understand events that are still to come. According to Woudenberg (1991), the name Delphi was coined by the philosopher David Kaplan, who at the time was working for the RAND Corporation. He discovered that in certain conditions unstructured and direct interaction with experts did not lead to better results than statistical aggregation of opinions. Hence, the term "collective intelligences" is often associated with Delphi, which means that, at least in certain controlled settings, the forecasts from structured groups are more accurate than those of unstructured groups. To further the research and make better use of the potential of expert polling, the Delphi method was developed in a series of studies conducted between 1950 and 1963 by Gordon, Helmer and Dalkey, all of whom were also working for the RAND Corporation at the time. The military nature of the experiments kept Delphi a secret until 1963, when the first article regarding the method was published.

The aim of the method is to create a tool for forecasting that is both systematic and interactive, while relying on an expert panel to give insights into the studied topic. The idea is to achieve consensus in topics where others outside the expert panel, regardless of their position, could not influence the decision making (Okoli & Pawlowski, 2004). Delphi is commonly found in the literature on futures research, and examples of T&L related studies using the method include those by e.g. Gracht & Darkow (2010), Julsrud & Uteng (2015), Liimatainen et al. (2013), Melnyk et al. (2009) and Ojala et al. (2013).

Delphi has come a long way since it was first discovered, and various forms of conducting a Delphi study now exist. Even though the definition of Delphi is not absolute, some common factors should be found in each of the variations. According to Rove and Wright (1999), four major features define the method in use to be a Delphi:

- Anonymity
- Iteration
- Group response
- Controlled feedback

Maness (2012) argues that usually all the experts in a panel maintain anonymity. This is achieved by the use of questionnaires. Such anonymity is vital because a normal part of human interaction is to cede one's opinions to a reputed individual or to strong and charismatic personalities, regardless of whether their opinions and arguments are scientifically backed up. This effect is negated by anonymity. Furthermore, anonymity negates peer and social pressure, as there is no longer a risk of losing face even if an answer is wrong. (Riggs, 1983; Rove & Wright, 1999.)

To collect the data, there is typically a questionnaire with several rounds. After each round, a synthesis of all the answers is presented, and the experts are given a chance to adjust their opinions. The group response is typically presented in the form of the mean or median values of the answers. If necessary, arguments why the answers are as they are might be presented, while still maintaining anonymity. Anonymity is also maintained during the iteration over a number of rounds, offering experts the opportunity to change their minds without embarrassment. (Okoli & Pawlowski, 2004; Rove & Wright, 1999.)

The feedback is normally controlled by one or more researchers called facilitators. The facilitator creates questions for the surveys and sends them out to the selected panel of experts, who review them and answer them if the questionnaire is deemed clear and sufficient for the purposes of the research. The facilitators collect and analyse the results of the survey and point out the questions that received mutual or conflicted answers. The answers are then sent back once or multiple times depending on the researchers, with the aim of reaching consensus. (Rove & Wright, 1999.)

According to von der Gracht (2008), Delphi allows the reduction or elimination of the *bandwagon, underdog, and halo effects.* The bandwagon effect signifies that individuals start adopting the policies, or even the behaviour, of others because a number of people are already doing it, instead of analysing the situation and relying on evidence (Meyer et al., 1998). A similar lack of reasoning happens to individuals suffering from the underdog effect, as they are prone to sympathise with the losing side, even when there is no solid factual or scientific reason to do so (Kauko & Palmroos, 2014). The halo effect in turn causes people to side with somebody because of their overall impression and not the strength of their arguments (Kauko & Palmroos, 2014). These psychological effects are largely due to functions that are related to emotional reactions that happen in human interaction, and which can be minimised with anonymity. Hence, the aforementioned phenomena are diminished to some extent in the Delphi method.

As the Delphi method is adjusted to each specific research setting, evaluation of the reliability and validity of the method is difficult. Most studies reviewed for this thesis in which the Delphi

method was used evaluate the entire research and not so much the Delphi-method itself. However, generally articles both for and against Delphi can be found. Affirmative studies, such as those conducted by Iqbal and Pipon-Young (2009) and Landeta (2005), present Delphi as a superior method specifically when creating forecasts when no definite answers are available. However, e.g. a study conducted by Woudenberg (1991) found that Delphi required more work but did not give improved results over less demanding and time-consuming methods.

Helmer (1977) argues that the Delphi method has been criticised for basing forecasts only on opinions, and going against the rules of random sampling in the so-called polling of experts. However, these objections are often based on a misunderstanding of what the purpose of Delphi is. When making the above criticism, it is important to point out that the method is not an opinion poll that relies on taking a random sample of a population of experts. On the contrary, Delphi is applied after the group of experts has already been chosen, regardless of how the choosing was done, and the purpose is rather to provide a communication method for the selected group.

The methodology available for polling experts is vast, and certainly other options were available than the Delphi method. However, it was chosen for three reasons:

- It appears often as a method for conducting futures research.
- While it can still be debated whether experts should be consulted, there are no absolute methods for predicting the future, and the reviewed literature does not unanimously present any method as superior.
- The preceding studies by Ojala et al. (2013) and Leino (2014) used the Delphi method as well. As this thesis continues the work of these studies, the same method was preferred to keep the comparability of the results as reliable as possible.

While making decisions based on future forecasts carried out with the Delphi method, it should be noted that there is still a high error margin in such studies. However, this can be considered a characteristic of futures research, and the aim is to find the possible rather than absolute directions of future development. When there are no absolute correct answers, the second-best option in futures research is consensus of opinion (Paliwoda, 1983).

2.2 Weak signals, trends, megatrends and wild cards

As the resources available for futures research are in most cases finite, it is not possible to be fully prepared for every situation. The decision-maker needs to decide what to prepare for and how. Typically, events with a high estimated probability of occurrence should be focused, while not entirely forgetting events with lower probabilities. This chapter discusses some of common concepts on the likelihood of futures: *weak signals, wild card trends* and *megatrends.*

Weak signals are early warnings, signs of future changes. They are difficultly interpreted cues of inevitable events that are difficult to recognise in the present, but which are going to generate a strong trend in the future. (Bishop & Hines, 2012; Ilmola & Kuusi, 2006.) They do not signify the emerging events but instead the signals of those events. Often and widely emerging themes as rumours or forecasts in the scientific literature, but which have not yet been realised, can be

considered weak signals. The strength of the signals correlates to their visibility or quantity. The higher the visibility and quantity, the stronger the signal, and vice versa. For example, there were weak signals on climate change for years before it was considered a trend. The signals gradually got stronger and stronger by gaining more visibility and acceptance, and finally the phenomenon was acknowledged and gained wide recognition in the scientific community. (Hiltunen, 2010.)

Trends are the expected directions of future developments. They are more likely than *wild cards* but never certain. Without disruptions, they continue on the expected trajectory but can just as easily break off from it, and consequently create an unexpected future. They are not as covert as *weak signals* but can already be seen in the investigated environment. The popularity of a trend varies, but when a trend becomes widely accepted, it is often referred to as a *megatrend* in the literature. Megatrends are large, often global, trajectories of long-term change. They are further defined as waves of development with a distinct history and direction; a set of macro-level phenomena that may contain multiple trends. (Kaivo-oja, 2012; Myllylä et al., 2016; Toivonen, 2004.)

Wild cards were introduced in a study by BIPE Conseil (The Copenhagen Institute for Futures Studies) by Petersen et al. in 1992 (Petersen & Steinmüller, 2009). Wild cards signify improbable events that have substantial consequences if they occur. According to Hauptman and Hoppe (2015), these kinds of unexpected events often take decision-makers by surprise. Major surprises happen when relevant *weak signals* are left unnoticed, neglected, or sometimes even denied. The consequences of unexpected wild cards taking place can be dire, as the wild card by definition means that the effect of the phenomenon is significant. Futures research can be critical for identifying potent wild cards and understanding their probabilities, as they are often difficult to spot unless they are specially looked for. (Rij, 2013.)

2.3 The human factor

An aspect that seems to be surprisingly lacking—or discussed only very superficially in the futures studies-related literature—is the irrationality of human behaviour. We discussed before that futures studies cannot make absolute predictions of the future. Perhaps the greatest reason is that almost without exception, making forecasts involves people and the actions of people. However, people have what we call free will, which makes them very hard to understand and their actions very difficult to foresee. A common objective for people, excluding financial goals, is to try to make sense of life and to find purpose and happiness, and direction for the activities done. This might sound somewhat vague, but it is important to understand what drives humans, at least on a general level, when conducting a study that fundamentally relies on their interactions. (Ehresmann, 2013.)

In 1957, Herbert Simons introduced the concept of bounded rationality, for which he was later awarded the Nobel Prize. The basic principle is that people are making rational choices that economic (and other) theories are so often based on, but that human rationality is rather limited, and this is reflected in their decision making. Even though many of Simon's findings are still considered relevant, it should be noted that the research is somewhat outdated and based on simplified views of human behaviour. In their Nobel-winning research, Kahneman and Tversky continued on the road that Simons paved for them years before. The key finding in their

vast amount of research on behavioural psychology was that the driving force of humans is not logic but intuition, and intuition unfortunately tends to be wrong. Richard Thaler proceeded to strengthen these assumptions by conducting a series of experiments, with the results showing that people tend often to act irrationally without properly analysing future consequences. (Hatchuel, 2001; Kahneman, 2011; Thaler, 2015.)

The future cannot be predicted, because humans are the agents of history, and as long as humans have free will there will be uncertainty. This problematic human factor may create challenges in futures studies, as it means that the studied systems are often in a chaotic state, and the development cannot be reliably predicted. Making predictions that look logical on paper easily leads to failure in large systems. It does get more manageable, however, when the system is small and simple, or when it includes a minimum amount of human decision making. This can be addressed, for example, by dividing the system into smaller pieces. Comprehensive structured research, if done well, will reduce the effects of finding false causalities between events when making decisions based on intuition. Hence it provides a powerful tool for policymakers, who are often equipped with limited time and research, to help them make the difficult choices regarding complex topics. (Aaltonen & Barth, 2005; Slaughter, 1998.)

3 MEGATRENDS IN TRANSPORT AND LOGISTICS

The T&L sector is an important part of the socio-political and economic environment of countries or regions. The importance of the industry was long neglected and T&L considered more of an irrelevant necessity, but according to the Connecting to Compete report by the World Bank (Arvis et al., 2018), recognition of its value has grown in the past decade and is still trending upwards. This well-earned popularity is growing because properly managed logistics contribute to the cost efficiency of the supply chain and hence the entire business.

As logistics essentially involves organising and planning, predicting upcoming changes is an important factor in securing the efficiency of operations in the long term. According to McKinsey and Company (2015), 60% of growth can be attributed to being in the market at the right time, which in turn emphasises the significance of futures studies in the T&L sector. Nevertheless, only 40% of companies systematically consider the importance of timing when entering the market. The potential of futures research in T&L has therefore been recognised but not fully realised (Gracht & Darkow, 2010). In this chapter we take a glimpse at the prevailing T&L trends of our time and the possible developments around the corner.

The pace of technological change has continued to rise in the recent decades, trends and megatrends in the T&L sector are forever shifting, and the globalising political landscape is not showing signs of permanent stabilisation. Companies have the demanding task of keeping abreast of all this if they wish to maintain their market share and maximise their profits. Important trends in T&L have been discussed in the literature, for example by Bowersox et al. (2000), but have changed multiple times since the start of the millennium. The literature review conducted in this chapter aimed to identify the current megatrends, of which the following seven stood out:

- Technology-driven process changes
- Environmental concerns and regulation
- Globalisation
- Urbanisation
- Energy constraints
- Ethical consumer behaviour
- Supply chain resilience

The number of different trends, megatrends and wild cards in the existing literature is vast, and certainly the research conducted in this thesis was not exhaustive. It simply intended to capture the often-emerging topics regarding the future of the T&L sector. These topics are discussed further in the following subchapters.

3.1 Technological advancements

One of the greatest boosters to the pace of development is technological innovativeness. Technology, and science in general, is taking huge leaps and growing exponentially. For example, in 2019, some 4.6 billion people have a mobile phone as an important part of their daily life, which is a huge change in just 35 years since the first ever commercial mobile phone was made

available by Motorola in 1984. The spread of technology has increased productivity and lowered the necessity for dull, physical and dangerous jobs. However, technology can also bring problems such as cyberthreats and a greater need for a highly educated and talented workforce. (Statista, 2019; WEF, 2019)

Technology plays an important role in the T&L sector's progress as well. Consumer power has increased through smartphones, which make it easier to compare product prices, and ordering an item from across the ocean is but a few clicks away. Recent advancements such as RFID, tracing and tracking and the electronic waybill have already improved the efficiency of many companies. With countless emerging technologies that hold potential in the world of logistics, it can often be challenging to recognise those that become significant. Like with other trends, one way to map out the wide array of technological advancements is to delve into the literature and try to find repeated patterns in discussions regarding the acceptance and usefulness of the technology. In the recent T&L literature the following often emerged: Artificial Intelligence (AI), robotics, Big Data Analytics (BDA), the Internet of Things (IoT), Virtual- and Augmented reality (VR, AR), 3D printing, blockchain, drones and autonomous vehicles (WEF, 2019; PWC, 2019).

The industrial revolution took the world economy back to the drawing board and created societies largely different from ones that had existed before, with a new large social group emerging: the working class. Now, in the 21st century, most of the dull, industrial jobs have been automated, shrinking the size of the workforce. The development of advanced robotics is most likely going to reinforce this effect in the future. The benefits of this include fewer repetitive and dangerous jobs, improved accuracy and efficiency, and lower costs of production. The downside, however, is the loss and sometimes complete elimination of jobs. (DHL, 2016b; PWC, 2012.)

An Unmanned Aerial Vehicle (UAE), often referred to simply as a drone, is an airborne vehicle able to operate without a pilot. UAEs face similar challenges that planes and helicopters do in energy efficiency, as putting them in the air is more demanding than moving on land or water. However, if an item to be delivered is small, it could be more efficient, and definitely faster, to fly it over with a drone than drive it on the roads in a taxi. One of the largest companies in the world, Amazon, has already taken the UAE into use for parcel deliveries. Nonetheless, it is not expected that UAEs alone will revolutionise the industry; more likely they will eventually find their place in the supply chain. (DHL, 2014b; Kakuya et al., 2012)

Big Data will play a role in the economy of tomorrow and is already out there. Large amounts of information will have to be harnessed by creating algorithms and tools that filter the important bits from the unnecessary mass. The refined data could then have applications such as forecasting and optimisation and streamlining of logistics processes. IoT is a promising technology that has already gained a wide following, and its network of digital tendrils is reaching logistics as well. It plays well together with BDA, as the connected devices can constantly gather data related to their operations. This data can then be used to optimise these operations. Multiple other applications are also available, such as more cost- and time-efficient tracking and tracing through connected devices along the supply chain. However, IoT has suffered some criticism for creating new openings for cyber- and/or hybrid threats, as access to large systems could be gained by infiltrating one device connected to the network. (Cederberg et al., 2017; DHL, 2013a; Lee & Lee, 2015.)

New opportunities afforded by advanced computers such as the ever-developing AI are most likely going to expand rapidly in the future. The technology is already available for consumers, for example in smart homes. Computing power is crucial for the development of more sophisticated AI, and innovations such as the quantum computer could quickly speed up the evolution of AI, but this has not yet been implemented in a way that would surpass binary computers in a practical manner. (DHL, 2018; PWC, 2019.)

3D printing (also known as additive manufacturing) is something that just a few decades ago still sounded like the stuff of Sci-Fi movies. Imagine no longer having to go to shops but simply being able to browse items online and print them out in the comfort of your home. This is still not quite in the grasp of the ordinary consumer, but companies are starting to use the technology. Adidas, for example, is planning to 3D-print its sneakers in large quantities in the coming years. In manufacturing, at least in certain industries that use simple components, this technology could be revolutionary. Instead of buying the parts from different suppliers and possibly from far away, the company only needs to buy the material required for the printing and create the parts themselves. It remains to be seen what kind of an effect this will have in the future. (DHL, 2016a; Forbes, 2018.)

There has also been research and development (R&D) on autonomous vessels, which are capable of operating without any crew. In maritime logistics this would increase the need for permanent and clearly marked shipping routes, and also with other transportation methods safety measures will need to be improved. The use of recreational vessels would have to be more tightly regulated to maintain safety. Like many other of the technologies discussed here, autonomous vehicles may be considered a wild card. This is being tested and already used on a small scale, for example by Yara in Norway (Yara, 2018). However, replacing current ships or vehicles with their autonomous counterparts on a large scale is most likely not going to become a reality in the near future; if it did, it could have a significant impact on the industry. (Centrum Balticum, 2017; DHL, 2014a.)

With all the upcoming technological advancements we are standing on the brink of a fourth industrial revolution, which will blur the lines between physical, digital and biological environments. We do not yet realise all the possibilities that will become available. The provided increased intelligence and technological prowess is going to enhance T&L. The technologies will play a role in the economy of tomorrow, but it is hard to say which ones are the key players. Major advances in remote control, tracking and tracing and automation have already been implemented, but the large-scale effects on other innovations such as autonomous vehicles are still to be seen. Companies are waiting to see where this revolution will take them and which innovations will triumph, and a lot of hope is set on the possibilities provided by the coming technological advancements. (Ben-Daya et al., 2017; Osuuspankki, 2019; Schwab, 2016.)

3.2 Globalisation and urbanisation

The world is changing rapidly in terms of two demographic phenomena, globalisation and urbanisation, both of which have significant effects on the T&L industry. The world is becoming more connected and the economy even more liberal through increasing globalisation. Cheap labour is drawing advanced economies towards emerging ones, serving as a basis for the

formation of large multinational and intercontinental supply chains. Companies engaging in such endeavours are usually motivated by cost savings and strategic advantages such as access to new markets. Technology has made it possible to manage geographically vast supply chains in an efficient manner. This age has also given birth to megacities as populations are drawn increasingly to urban areas, creating a need for logistics processes that are suited to operating in narrow and packed urban conditions. (McKinsey & company, 2018)

Globalisation as a phenomenon has long been discussed, but the changes it brings have not stopped. While international trade between advanced economies has boomed, there are still large potential economies that have not yet entered the field of international business or are still in their infancy. One emerging trend in the literature on global economic shifts is the increasing power of the large Asian economies, such as China and India (DHL, 2018). Figure 3 illustrates the share of global GDP between advanced and emerging economies.

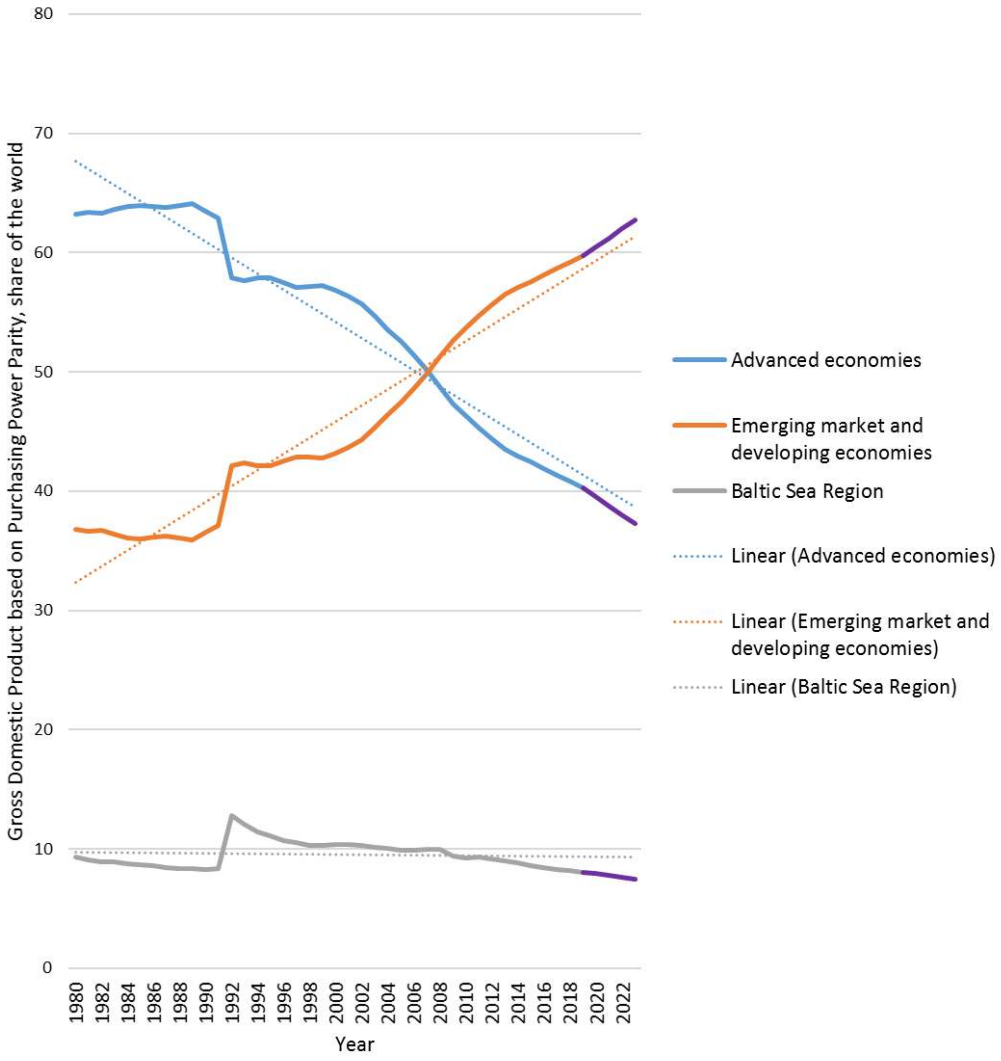

Figure 3 Shares of GDP of the BSR[-1], advanced and developing economies in relation to global GDP (IMF, 2019b)

Figure 3 says nothing about how GDP growth has changed in individual countries, but instead compares how the combined global GDP is shared between advanced and emerging markets. It

shows that emerging markets, consisting largely of Asian powers with China being the biggest, have left the advanced economies behind. An additional observation is that the BSR^{-1} curve followed the emerging markets curve on an upward spike around 1992, while the advanced economies' share of GDP slumped noticeably at that time. This was probably partly due to the collapse of the Soviet Union and the following economic growth in these countries. Recently, the trend has been downwards in the BSR^{-1}, as it is with the advanced economies. Most likely, the trends of the emerging and advancing economies will stabilise and the development will reach saturation point, with the trends becoming more horizontal, once the emerging economies have industrialised and the political-economical situations become more stable. The figure also reveals the economic power of the BSR^{-1} on a global scale, with the share of global GDP shifting by around 10%. The development in the emerging economies could cause demographic movement in advanced economies, including the countries of the BSR^{-1}. Cheap labour, combined with improving infrastructure and regulation, provide tempting opportunities for business (Moraglio & Dienel, 2015; PWC, 2012).

3.3 Environmental concerns and regulation

Climate change is a megatrend that will bring various challenges in the coming years as its effects are slowly realised. In addition to the widely discussed effects of climate change on the global environment, increased pollution combined with swelling urbanisation will create significant challenges for healthcare; as it stands, urban pollution is already responsible for more than 1 million premature and 1 million prenatal deaths every year. Due to the harm caused to people and the environment, industries are heavily regulated (including the T&L sector) in terms of their GHG emissions and other practices contributing to negative environmental changes. Publicity has led to changes in consumer behaviour and a growing trend to prefer environmentally friendly and ethically sourced products, and to a boom in R&D focused on the search for alternative energy sources and more environmentally friendly ways of doing business. (DHL, 2013b.)

According to a Delphi study conducted by PWC (2009), alternative fuels and high oil prices are unlikely to revolutionise the world or the T&L sector, but they will have a notable impact. Challenges will be posed indirectly by the need to track, document and disclose CO_2 emissions as the world fights to bring down global GHG levels. Tracking and R&D are not cheap, and significant cost increases in the T&L sector are anticipated.

3.4 Energy and resource constraints

Humankind is dependent on a multitude of various resources, some of which are essential for the preservation of life, and some of which are vital for industrial production and transportation (Halldorson & Kovács, 2010). The environmental crisis has set new rules for energy and resource consumption, with some resources starting to get scarce due to their heightened consumption. For example, rising oil prices, amongst other energy resources and materials, are going to affect the cost-effectiveness of the transport sector. However, the increasing supply of alternative fuels and developing fuel technologies and synthetic materials will diminish this effect to some extent. According to a forecast by the PWC (2009), renewables will see notable growth by the

year 2030, even though a major energy turnaround seems unlikely. However, if the unlikely scenario of an important resource experiencing a drastic price increase such as oil prices soaring to four-digit numbers per barrel, it would have serious ramifications on the industry. Relocation of production sites and regionalisation would be probable consequences. Natural disasters or major political conflicts could cause the scenario to come true, and for this reason companies should have a plan in case it actualises. (PWC, 2009)

The use of already scarce resources is anticipated to increase further with the rising standards of living in emerging economies and the growing global population. Certain new trends, such as the sharing and circular economy, have started to emerge due to the requirements and incentives to save limited resources. (Bell et al., 2013.)

In the linear economy, a model popular in the last few decades, the products end up as waste at the end of their lifecycles, with lots of resources being destroyed in the process. However, the linear economy has been stepping aside as it makes room for the circular economy. In this alternative model, the products are used in a closed cycle in an efficient manner with the purpose of consuming minimal amounts and reusing them as much as possible. Products are often assembled bearing in mind that they can be reused when they reach the end of their effective life cycle. (DHL, 2015b; Van Buren et al., 2016.)

The sharing economy, part of the sustainable trends and often related to the circular economy, is in its essence a new model of consumption in which temporary access to services or goods is preferred over actual ownership. It can be utilised in the T&L industry by sharing or outsourcing certain functions to individuals or other companies. Examples of well-known sharing-economy companies are Uber and Airbnb. (DHL, 2017.)

3.5 Consumer behaviour

In addition to the requirements laid out by regulation, companies need to understand changing consumer behaviour. Values and lifestyle make a difference in consumption habits, and companies should be encouraged to build their supply chains in a way that fulfils the consumers' needs and standards.

One of the trends of our time is the increased moral contemplation of consumers regarding what products to buy and which services to use. The demand for environmentally friendly and ethically sourced products and services is surging, especially in advanced economies (DHL, 2013b), due in part to more extensive media coverage and easy access to information. People have a desire to understand how their consumption affects the world, and the services of unethical companies are often avoided or even downright boycotted. According to DHL (2015), 71% of consumers have stopped buying certain products at some point because a company had behaved unethically. Unethical behaviour leading to boycotts often relates to e.g. the use of child labour, cutting down rainforests or other 'non-green' actions, or any events that cause anger and contempt in the population.

These changes are not only due to a shift in the consumers' moral compass. Changes in people's preferences due to an increase of wealth in the population, combined with a growing customer base, will also place stress on supply chains. Combined with the current technological readiness

globally, this will lead to substantial growth in levels of online shopping. (WEF, 2019; WMRD, 2012.)

3.6 Supply chain resilience

Multiple technological advances over the last few decades have altered supply chain requirements when in it comes to resilience. Resilience is the ability of the supply chain to sustain its functions under unexpected circumstances. Information systems, for example, have brought multiple new possibilities for companies but created completely new threats as well. Aspects such as the rising costs of cybersecurity will (or already have) become reality for companies in the T&L industry. According to PWC (2011), cyberattacks are posing an increasingly probable threat in the future, thus investing in security against such attacks is mandatory.

In addition to criminal activities, the supply chain might sometimes have to withstand unexpected events such as natural disasters, political and military conflicts and other drastic changes in the operational environment. Urbanisation and globalisation together form vast but highly concentrated webs of supply chains, where one major disruption can have large and unpredictable consequences (Neilson, 2012).

Some functions are more important to the supply chain than others. For example, a crucial aspect of resilience nowadays is electricity and IT networks. Most modern-day functions rely heavily on these infrastructures, and a power outage or hybrid attack can cause drastic disruption to the supply chain. Resilience can be improved by finding and then focusing on the safety and security of these chokepoints and vital functions in the supply chain.

4 SCANNING THE BALTIC SEA REGION

Confucius said, "*Study the past if you would define the future."* Following this old wisdom, we aimed to carry out a brief analysis of the current state of things in the BSR^{-1}. History is an important part of futures studies, as it brings us to the present, and the present in turn must be understood and defined for the building of reliable foresights to be possible (Ehresmann, 2013).

4.1 History of the region

One of the defining features of the region surrounding the Baltic Sea, and an important factor in its history, is the sea itself. The Baltic Sea carries a significant importance in the BSR^{-1}, as in days of old it often provided the only connection for trade. Even to this day it provides the most important commercial routes between the countries in the area (Kivikari & Antola, 2004).

Geographically, the Baltic Sea is an inland sea of the Atlantic Ocean which separates the Scandinavian Peninsula from the mainland of Northern, Northeast and Central Europe. It covers an area of roughly 390 000 square kilometres, with the larger drainage area of the Baltic Sea adding 1 745 000 square kilometres more. The sea is confined to its northernmost part near the Finnish-Swedish border in the Bay of Bothnia, its easternmost edge by the Russian city of St. Petersburg in the Gulf of Finland, and its southernmost part in the Szczecin Lagoon, close to the Polish city of Szczecin. The westernmost part is a bit more controversial. In the past, customs fees granting access to the Baltic Sea were collected in various parts of the Kingdom of Denmark. Generally, although other definitions exist, the line is drawn between Copenhagen and Malmö in the southern part of Øresund, where the depth of the sea is no more than 7 metres. (Henningsen et. al., 2017.)

The deeper route out of the Baltic Sea passes through the Great Belt, the deepest of the three major Danish straits. However, even this sets some size limits to modern vessels; the largest ship in its overall dimensions currently able to enter the Baltic Sea is the *Baltimax*, with a fairway depth of 15.4 metres. The largest vessels roaming the oceans are not capable of entering the Baltic Sea at all (Uchacz & Galor, 2013). Despite the limitations on vessels plying international trade, the sea has long provided vital means of communication and commerce and often brought the countries on its shores closer to each other.

Even with the long-standing trade relations between the countries, the history of the region is not without conflicts. The BSR^{-1} is at the crossroads between west and east, and throughout history the region has been marked by ethnic, cultural and ideological borders. However, since the Cold War, the BSR^{-1} has seen significant changes unite its countries, and the separation and major conflicts of the past have switched to regional cooperation based on shared challenges and opportunities. Now the BSR^{-1} is a prominent area with successful economic coordination between its countries and stable rates of growth. There is also cooperation in other fields such as spatial planning and infrastructure, environmental protection, and fighting disease and organised crime. (Henningsen et al. 2017.)

Despite the ever-increasing cooperation and unification of the region, to this day differences within the BSR^{-1} can be found, and one division could be made between the west (Nordic countries and Germany) and the east (Baltic countries, Poland and Russia). This is, however, only

a directional division, and for example the positioning of Poland is controversial. This view derives from the times of the Soviet Union and the Cold War. Of the eastern countries, the Baltic countries have increasingly strengthened their relations with western countries through agreements and trade. Russia has kept a slightly greater distance, although in the past few decades the country has been getting more involved in global agreements and trade than in the 20th century. (Borre, 2005.)

4.2 PESTE

As we discussed earlier, it is necessary to conduct a futures scanning of the BSR^{-1} for a successful analysis to be possible. According to Maness (2012), there are various ways of structuring the subject of the research, and the macro level analysis includes typically the following factors:

- Economy (GDP, economic growth, future trends etc.)
- Government (political climate, import and export restrictions etc.)
- Legal (environmental protection laws, union and worker safety laws etc.)
- Technology (new products and services, new manufacturing processes etc.)
- Ecology (ecological concerns that affect manufacturing etc.)
- Socio-cultural (demographic factors such as age, population size etc.)
- Potential suppliers (quantity and quality of labour available, wages etc.)

In this thesis we will structure the futures scanning using PESTE analysis. The listed factors are included in the PESTE themes as follows: political (government), economic (economy), social (socio-cultural, potential suppliers), technological (technology), environmental (ecology). The legal theme is discussed in all of the themes as part of the bigger picture.

According to Yüksel (2012), PESTE analysis has several names such as STEPE and various forms with depending on the categories, such as PESTEL (added legal theme), and PEST without the environmental theme. The analysis can be structured in many ways, but the general idea is to provide a view of the macro environment of the researched company or region. The PESTE themes have been used in futures scanning before, for example in the early warning system developed for the Kuwait Oil Company by the Millennium Project[3] (Gordon & Glenn, 2009). In the following subchapters, the PESTE themes are reviewed one by one.

[3] The Millennium Project is a futures research think tank working on a global level, with the aim of improving futures studies and making it more available (The Millennium Project, 2018).

4.2.1 Political state of the region

As mentioned before, the BSR^{-1} countries are engaged in cooperation among themselves on a common basis. It is the first region in Europe to receive a macro-regional strategy. The European Union Strategy for the Baltic Sea Region (EUSBSR) was announced by the European Commission in 2009 and accepted by the European Council later on the same year. There are three main objectives stated for the strategy:

- Saving the sea
- Improving the connectivity of the region
- Increasing the prosperity of the region

Officially, the countries involved in the EUSBSR are Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland and Sweden. However, cooperation with Belarus, Iceland, Norway and Russia is welcomed. (The Council of the European Union, 2009; EUSBSR, 2018.) The BSR^{-1} countries work together with set regional goals, but are also cooperating via other multinational organisations, unions and agreements. Most of these which include multiple BSR^{-1} countries are listed in Table 2.

Table 2 Memberships of the Baltic Sea Region countries in various organisations, treaties, unions and agreements in 2019 (Arctic Council, 2015; CBSS, 2019; EFTA, 2018; European Commission, 2019; European Union, 2019; NATO, 2019; OECD, 2019;)

Country	Abbreviated treaties and organizations									
	IBSR	EU	EEA	EZ	SC	NATO	CBSS	AC	NC	OECD
Denmark	X	X	X	X	X	X	X	X	X	X
Estonia	X	X	X	X	X	X	X			X
Finland	X	X	X	X	X		X	X	X	X
Germany	X	X	X	X	X	X	X			X
Latvia	X	X	X	X	X	X	X			X
Lithuania	X	X	X	X	X	X	X			X
Norway	X		X		X	X	X	X	X	X
Poland	X	X	X		X	X	X			X
Russia	X						X	X		
Sweden	X	X	X		X		X	X	X	X

IBSR = Interreg Baltic Sea Region, EU = European Union,
EEA = European Economic Area, EZ = Eurozone,
SC = Schengen Convention, NATO = North Atlantic Treaty Organization,
CBSS = Council of the Baltic Sea States,
AC = Arctic Council, NC = Nordic Council,
OECD = Organization for Economic Co-operation

As explained in Chapter 1.2, all of the countries listed in Table 2 are included in the Interreg BSR^{-1} definition. All countries in the BSR^{-1} are members of the EU excluding the partner countries Russia and Norway (Interreg Baltic Sea Region, 2018). However, it should be noted that the non-EU members of the group participate slightly differently than the others. Typically, cooperation is less complex and more intense between the EU countries, whereas working with Norway and Russia often requires additional negotiations and contracts. Despite not being a member state, Norway has access to the EU's internal market through its membership of the European Economic Area (EEA). Additionally, Norway, Russia and the EU member states Denmark, Sweden and Poland are not part of the Eurozone and still have their own currencies.

The Schengen Agreement allows border crossings between member states without border controls, which significantly affects mobility. The countries that signed the agreement together form the Schengen area. In 2016, 1.7 million people in the area worked in another Schengen country than the one they lived in. Nearly 3.5 million border crossings occur daily between the Schengen member states, and around 57 million transportations per year. Some member states see the resulting difficulty controlling immigration as a problem, and for this reason support the re-installation of border controls. (European Commission, 2018a.)

The restoration of border crossings and resulting slower borderline process would have a negative impact on the area's future economy and logistical competitiveness. It is estimated that with such a change, trade between the Schengen countries would drop by 10–20% (Karakas, 2016). According to BTO (2011), in recent years border controls between the Schengen countries and Russia have been reduced and simplified as well. However, the current political situation may shift the equation and further integration cannot be expected to the same degree as few years ago.

The other entities listed in Table 2 further illustrate how the BSR^{-1} countries are connected. Most of the countries have memberships in 80% or more of the listed entities. Exceptions are Poland with 70% and with Russia with 30% attendances.

In addition to those listed in Table 2, there are a number of broad international T&L focused organisations, unions and agreements with which the BSR^{-1} countries are involved, such as the International Maritime Organization (IMO), International Road Transport Union (IRU), International Civil Aviation Organization (ICAO), Intergovernmental Organization for International Carriage by Rail (OTIF) and the Organization for Co-operation Between Railways (OSJD). It is worth noting that all the BSR^{-1} countries are members of OTIF but only Estonia, Latvia, Lithuania, Poland and Russia, ergo the only the eastern BSR^{-1} countries, are part of the OSJD. (ICAO, 2019; IMO, 2019; IRU, 2019; OSJD, 2019; OTIF, 2019.)

The BSR^{-1} countries are also brought together by memberships in other international deciding bodies such as the International Monetary Fund (IMF), the United Nations (UN), the World Health Organization (WHO), the World Trade Organization (WTO), the World Bank and others. An exception to those listed is Russia's absence in the IMF (IMF, 2019a; UN, 2019; WHO, 2019; World Bank, 2019b.; WTO, 2019.)

Multi-organisational cooperation brings countries closer together, even in troubling times. Ketels et al. (2017) argue in a report by the Baltic Development Forum (BDF) that the initial crisis

caused by the announcement of Brexit[4] has caused the remaining 27 EU member states increasingly to support European integration. However, Danielson et al. (2018) argue in another BDF report that other events such as rise of anti-establishment and Eurosceptic parties have shaken the stability of the EU. On the European scale, the BSR^{-1} seems particularly vulnerable to anti-EU movements. This was seen, for example, in Poland, where the national-populist Law and Justice party (PiS) won the 2015 elections by a large majority. The party's victory was built on impressive socio-economic promises but also on anti-liberal and anti-EU attitudes.

A similar trend also exists in the Baltic countries, especially Latvia and Estonia, which together with Poland are sceptical of the EU's immigrant quota and distribution system. Similar events have occurred even in the Nordic countries, which have generally been viewed as highly pragmatic and pro-EU. In Norway, and later in Finland, populist right-wing parties have gained popularity and now have joint governing coalitions. Similar parties have gained power in Denmark as informal coalition partners, and in Sweden the right-wing Sweden Democrats gained some momentum, with 12.9% of the total votes making them the third largest political party (Danielson et al., 2018).

The same phenomenon has gained ground in Germany, which until recently was considered politically very stable even compared to other EU countries. The country's large governing parties, the Christian Democratic Union (CDU) and the Christian Social Union (CSU), as well as the Social Democrats (SDP), suffered a dramatic loss in votes in the latest election in 2017, their results being the lowest since the 1940s. The latest polls show that the difference in approval ratings between the SDP and the far-right party Alternative for Germany (AfD) is only 2–3%. (Danielson et al., 2018.) However, political shifts are a common occurrence and can have large deviations, thus it is difficult to measure the long-term effects of this development on the BSR^{-1}. Generally, the region is politically stable and well connected, with strong levels of cooperation providing solid ground for doing business, including in the T&L sector.

4.2.2 Economic state of the region

Politics play a big role in the economic stability and competitiveness of a region. Even though we previously concluded that the political state of the BSR^{-1} is fairly stable, according to a survey by the Finnish bank Osuuspankki, a large proportion (56%) of companies see the current state of world politics as a threat to economic development. One year earlier, the percentage was 44%. This is quite a substantial increase. (Osuuspankki, 2019.)

According to PWC (2010), GDP is the best indicator for forecasting demand for the T&L sector. Rising GDP and a strengthening T&L sector correlate strongly. However, most likely the causality in this correlation works both ways. The T&L sector is not only driven by the economic situation; a strong logistics performance has a notable impact on GDP as well. In general, the economic situation in the BSR^{-1} is similar to that of advanced economies and poses similar strengths and weaknesses. The major economic indicators are portrayed in Table 3.

[4] The ongoing process of United Kingdom leaving the European Union (The Council of the European Union, 2018).

Table 3 Economic indicators of the Baltic Sea Region in 2017 (CIA, 2018; UNCTAD Stat, 2018)

Country	Economic Indicators (2017)							
	GDP (Bn. USD)	**GDP Growth %**	**Imports (Bn. USD)**	**Exports (Bn. USD)**	**Inflation %**	**Debt to GDP %**	**FDI inflow (MM USD)**	**FDI outflow (MM USD)**
Denmark	325	2.2	95	113	1.1	36.4	-3 115	10 031
Estonia	42	4.9	15	14	3.7	8.8	784	19
Finland	244	2.7	62	60	0.8	61.4	1 328	1 727
Germany	689*	2.5	182*	231*	1.7	64.1	5 736*	8 101*
Latvia	60	4.6	15	12	2.9	34.8	721	92
Lithuania	91	3.8	30	26	3.7	36.5	595	-31
Norway	380	1.8	80	103	1.9	36.7	-8 297	-2 930
Poland	525	4.6	222	221	2	54.4	6 434	3 591
Russia	394*	1.5	21*	33*	3.7	17.4	2 488*	3 545*
Sweden	521	2.3	155	170	1.9	40.9	15 396	24 303
Total	3 270	2.9	877	983	2.1	34.33	22 070	48 448
GDP = Gross Domestic Product with purchasing power parity, FDI = Foreign Direct Investment *Values have been weighted								

As Table 3 shows, the countries of the BSR^{-1} are economically diverse. Major differences can be attributed to Denmark, Finland, Norway, Sweden and Germany having strong export-oriented economies while Estonia, Latvia, Lithuania, Russia and Poland are still catching up. However, the strong growth of the Baltic countries and Poland is fast narrowing the economic gap between the western and eastern countries. (BTO, 2011.)

Ketels et al. (2017) argue that despite the differences between the countries, development in the BSR^{-1} has been faster than anticipated. It surpassed, for example, the estimate in the State of the Region Report 2016 by the BDF. Monetary policy continues to support the development significantly in the BSR^{-1} with low interest rates and high levels of liquidity provided to the markets. The economic growth of the region is illustrated against the growth of the EU in Figure 4.

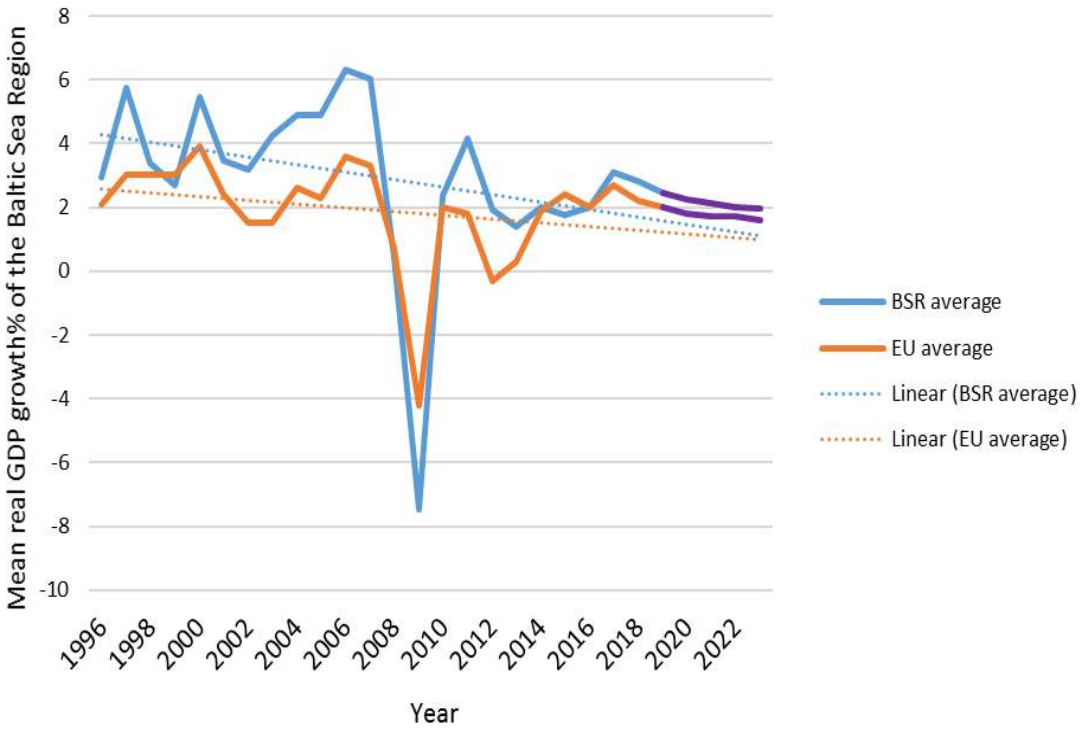

Figure 4 Comparison between real GDP growth of the BSR^{-1} and the EU (IMF, 2019b)

As seen in Figure 4, both GDP growth and the effects of the financial crisis of 2008 have been somewhat stronger in the BSR^{-1} than in the EU28 in general. The purple segment in the figure depicts the forecast by the IMF of expected future GDP development (IMF, 2019b). Despite the downward trend, the economies tend to grow in the long term, thus it is expected that the trend will reverse eventually.

4.2.3 Social state of the region

In this chapter we discuss the social state of the BSR^{-1}, focusing on demographic factors such as age and education of the population. Changes in demographic patterns have major impacts on

socio-economic development and are a major cause of acceleration of regional disparities (Böhme et al., 2016).

Perhaps one of the greatest demographic challenges in the BSR[-1] which will probably have a negative influence on the GDP growth of the region is ageing of the population. Europe has the fastest ageing population globally, with the BSR[-1] close behind. The severity varies by country, with the lowest age dependency ratios[5] (hereafter ADR) in the Nordic countries, Russia and Germany. One of the reasons for the low ADR in the EU and BSR[-1] is the baby boom[6] that followed the Second World War. The situation in the Baltic countries is slightly better. The average ADR of the BSR[-1] and EU is presented in Figure 5.

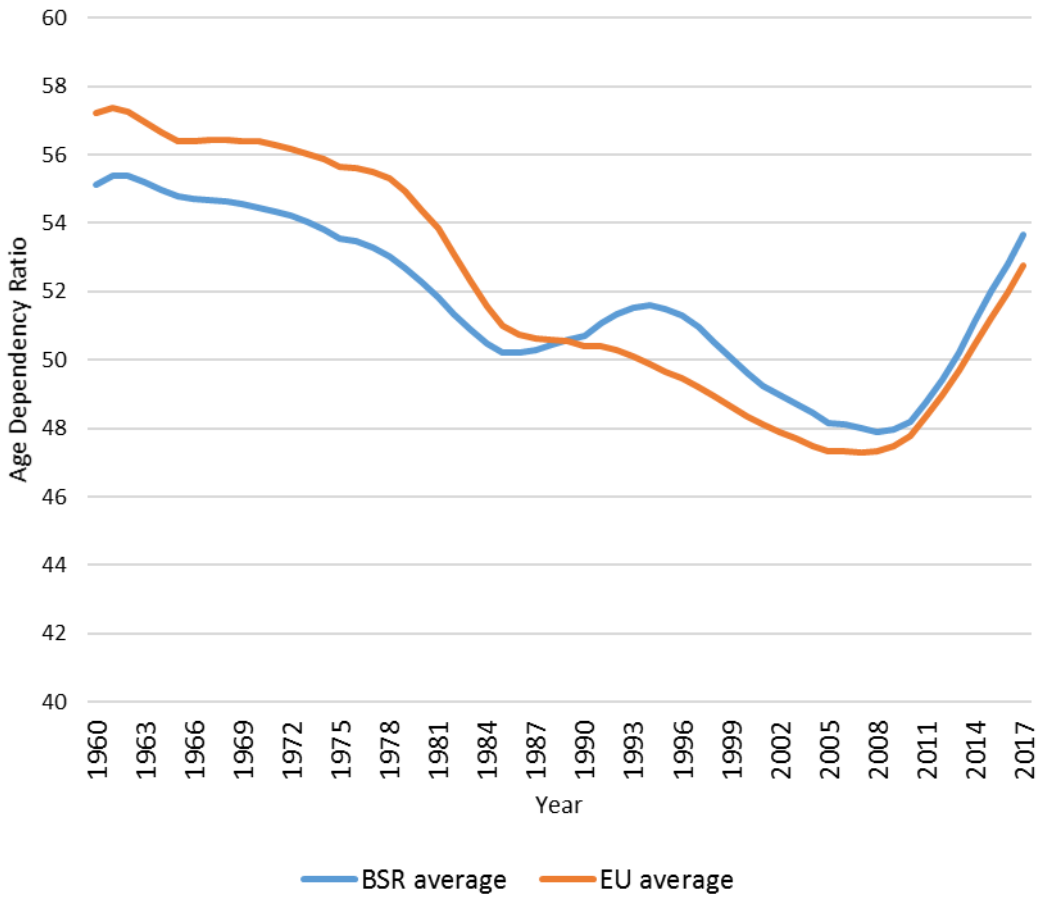

Figure 5 Age Dependency Ratio in the EU and BSR[-1] (World Bank, 2019a.)

As can be seen in the figure, the BSR[-1] and EU are very similarly developed. The current trend seems to be upwards for both. According to Böhme et al. (2016), the BSR[-1] countries' elevated median age in the future needs to be addressed to secure the recruitment and competitiveness

[5] Ratio of citizens younger than 15 or older than 65 years to the rest of the population (World Bank, 2019a.).

[6] A significant increase in birthrate among a particular group of people during a specific time period. (Cambridge Dictionary, 2019.)

of companies. Other social indicators describing the demographic structure of the BSR^{-1} are listed in Table 4.

Table 4 Social indicators of the Baltic Sea Countries in 2017 (CIA, 2018)

Country	Social				
	Population millions	Median age Years	Total dependency ratio %	Unemployment %	Population growth rate %
Denmark	5.61	42.20	56.00	5.80	0.22
Estonia	1.25	42.70	53.70	5.90	-0.57
Finland	5.52	42.50	57.90	8.60	0.36
Germany	13.30**	47.10	52.10	3.80	-0.16
Latvia	1.95	43.60	52.50	9.00	-1.08
Lithuania	2.82	43.70	49.90	7.00	-1.08
Norway	5.32	39.20	52.10	4.00	1.01
Poland	38.48	40.70	43.90	4.80	0.13
Russia	14.00**	39.60	43.50	5.50	-0.08
Sweden	9.96	41.20	58.50	6.60	0.81
**Only the regions within the Baltic Sea Region definition are viewed					

As seen in Table 4, the already high dependency ratio is strengthened by the negative growth rate in many countries. In other words, not enough young people are born to support the quickly ageing population. The ageing population in the BSR^{-1} raises questions regarding the provision and financing of social welfare and pension systems in these countries. Strong structures taking care of the elderly are costly, which will become noticeable in the economic development in the coming years. (Böhme et al., 2016.)

Aside from the age-related demographics, the global middle class is expected to grow by 66% by the year 2030. Even though the global trend for the middle-class is to get bigger, in the BSR^{-1} it could in fact decline. More people might end up stepping down rather than climbing up the social ladder. All these trends also contribute to the attractiveness of the BSR^{-1} and certain areas within it. Brain drains[7] and migration are expected to increase in the future, and several European countries are now trying to respond to declining demographic trends by increasing immigration (Böhme et al., 2016; OECD, 2016.)

4.2.4 Technological state of the region

Political, economic and social conditions create an environment in which the T&L sector may operate, but technology creates the tools for its operations. As mentioned at the start of this thesis, the advent of new transportation methods such as trains or sea containers in the past brought significant changes to industry. There is no reason why these revolutions could not happen again. According to Osuuspankki (2019), companies' hopes for the future are based primarily on the new possibilities that technological advances could create.

Technological readiness comprises aspects such as R&D activity and prowess, rate of technological development, and incentives for research. As discussed in Chapter 4.3 on

[7] Emigration of educated people, leading to losses for the country of origin. (Beine et al., 2001)

competitiveness and illustrated in Figures 7 and 8, the level of technological readiness in the BSR^{-1} is similar to that of the EU and exceptional compared to global averages.

One major study which concentrates especially on the technological readiness of countries is the Global Innovation Index (GII). According to GII (2018), which is built on 80 different indicators, the region's technological state is comprised of innovations in manufacturing, processing and general expertise. The comprehensive index includes 126 countries representing more than 90% of the world's population. The GII scores of the BSR^{-1} countries vs. the European and EU scores are shown in Figure 6.

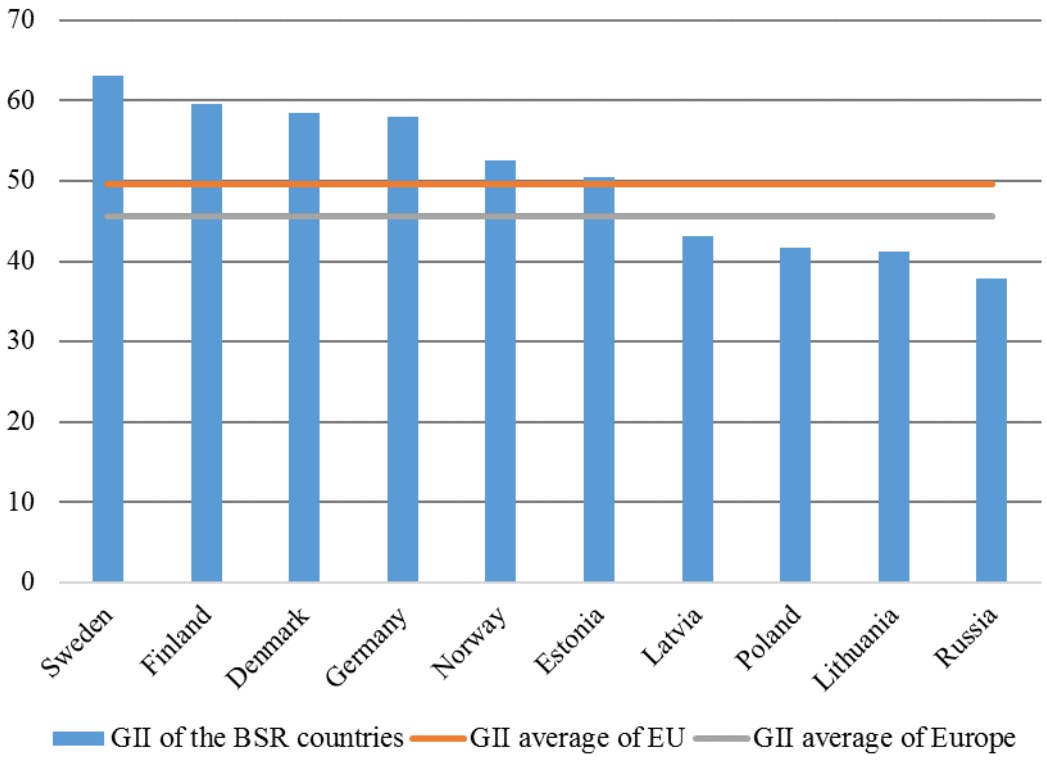

Figure 6 Global Innovation Index 2017 of the BSR^{-1} countries

As can be seen in Figure 6, the Nordic countries along with Germany rank high, all reaching above the averages of the EU and Europe. Estonia is in the top group here as well. Other BSR^{-1} countries fall a bit short of the European standards, and at the same time of the EU average. These results are on par with the other statistics presented earlier in this thesis regarding the division of the region into west and east.

A theme that has become increasingly important with rapidly developing IT is cybersecurity. With more systems being heavily dependent and tied to the Internet, possible threats have increased as well. New innovations often make existing systems rely even more heavily on IT, and the implementation of technologies such as the IoT carries the risk of creating even more openings for abuse. However, in the BSR^{-1}, cybersecurity-related education and research is flourishing. (Böhme et al., 2016.)

4.2.5 Environmental state of the region

One of the often-discussed themes of our time is the decreasing environmental condition of our globe, and the related regulation and control. International and regional rules and regulations aim to limit pollution and the harmful effects caused by it such as global warming. Two themes emerged in the literature regarding the environmental state of the BSR^{-1}: The pollution of the Baltic Sea and the greenhouse gas (GHG) emissions of the transport sector.

As stated in Chapter 4.2.1, the EUSBSR lists saving the sea as one of the most important strategic goals of the BSR^{-1}. The Baltic Sea, with its scarce water exchange with the Atlantic Ocean and brackish water, is an extremely sensitive ecosystem. It suffers from pollution and eutrophication, caused mostly by nutrients leaked into the water from fertilisers used in the region's agriculture. With more than 70 million people in the BSR^{-1}, the pollution of the shallow sea has become a serious issue. Additional threats include overfishing and invasive alien species that are brought in through ballast water from ships sailing the oceans of the world. (Henningsen et. al. 2017).

The Baltic Sea is already in a rather concerning state, as it is considered to be the most polluted sea in the world. It is ranked as one of the most vulnerable bodies of water along with the Great Barrier Reef in Australia, the Galapagos Islands of Ecuador and 14 other bodies of water. The International Maritime Organization (IMO) lists it as one of the Particularly Sensitive Sea Areas (PSSA) of the world. The PSSA classification means that specific measures may be used to control maritime activity in the region, which also causes the regulation of transportation vessels to be stricter than usual. (IMO, 2018a).

The IMO aims to limit the amount of pollution caused by maritime traffic through Emission Control Areas (ECA), in which emissions are strongly regulated. The regulated emissions are nitrogen oxide (NOx), particulate matter (PM) and sulphur oxide (SOx). It also aims to cut down CO_2 emissions by increasing the vessels' energy efficiency. A convention within the IMO called MARPOL is responsible for these regulations. The current ECAs are the following: The Baltic Sea-, The North Sea- and the North-American Emission Control Area. The IMO has the ambitious goal of reducing maritime GHG emissions by 50% from the 2008 levels by 2050 (IMO, 2018b; MARPOL, 2018.)

A more BSR^{-1} specific goal is that the EU is attempting to reduce emissions by sea and port operations by 40% from the 2005 EU levels by the year 2050. This objective includes traffic within the EU but excludes transportation from and to the Union. The objective is pursued through three measures: The first is to strengthen the monitoring and reporting of ship emissions from EU ports. Secondly, the EU seeks to reduce GHG emissions from ships. The third measure includes possible future measures. Other environmentally related goals set by the EU are reduction of the importing of oil and preservation of the Arctic. (Böhme et al., 2016; European Commission, 2017a; European Commission, 2011; Tilastokeskus, 2018.)

Regarding other transportation methods, the EU is aiming to reduce road traffic emissions within the Union by three thirds by 2030 and by 15% by 2025. The EU aims to reduce its total transport-caused GHG emissions 20% by 2020, 40% by 2030 and 60% by 2050, compared to 1990 levels. Another announced goal is to reduce emissions 20% by 2030 compared to 2008 levels. (European Commission, 2011; European Commission, 2017a.)

Despite the goal of the EU to reduce overall pollution, Poland and some other eastern European countries have been reluctant to implement measures required to achieve the aimed reductions of GHG emissions, particularly in the energy sector. The most important thing for Poland is cheap energy, less so energy purity, as in Poland carbon is seen as the basis of future development (EESI, 2018). The future will show how environmental regulations are adopted and put into practice in the BSR^{-1} countries.

Global warming and damage to water areas are not the only things caused by fumes; pollution also poses a direct health hazard. The WHO (2013) argues that CO_2 and other emissions polluting the air are responsible for 800 000 deaths in Europe alone. This problem is the worst in urban areas, with bigger cities typically suffering the most.

4.3 Competitiveness of the region

The PESTE analysis gives insight into the appeal of the region for companies to do business. On a global and even European level, the BSR^{-1} seems to be pretty competitive. A number of indices have been created for measuring the overall competitive state of a country, such as the Global Competitiveness Index (GCI) and European Regional Competitiveness Index (RCI), both of which are discussed in this chapter (WEF, 2012).

The GCI is one of the most comprehensive indices for understanding the general standing of a country in terms of competitiveness (WEF, 2012). A report by the WEF on global competitiveness compares the economic state of different countries and aims to help policymakers recognise the potential challenges and strengths of various economic strategies. Such information is what futures scanning aims to achieve. GCI, which was introduced by the WEF in 2005, uses the following 12 metrics to rate countries (WEF, 2018):

- Institutions
- Infrastructure
- Macroeconomic environment
- Health and primary education
- Higher education and training
- Goods market efficiency
- Labour market efficiency
- Financial market development
- Technological readiness
- Market size
- Business sophistication
- Innovation

Both public and private stakeholders affect the first metric of the GCI, the institutional environment. Competitiveness is strongly related to legislation and the administrate framework which sets the operational borders for companies, governments and individuals.

Infrastructure is vital for businesses and the government to operate efficiently and it includes electricity, telecommunications and different modes of transport such as roads, airports, railways and ports. The macroeconomic environment has a direct effect on business and hence on the competitiveness of the country.

Health and primary education are important simply because a healthy workforce is more productive, as is a workforce that has received a high-quality basic education. Higher education pays off as well. Today's highly efficient and global economy requires workers who are capable of performing complex tasks in a quickly changing environment, and such workers are gained by high quality secondary and tertiary level education.

Competition in the market and well-managed operations lead to high goods-market efficiency, which creates the sixth metric of the index. Another contributor to competitiveness is labour market efficiency and flexibility. A workforce allocated efficiently and motivated with the right incentives has a major effect on competitiveness.

The role of the financial markets is to keep the wheels turning. The availability of capital is essential for both businesses and individuals. The ninth pillar, technological readiness, contributes to competitiveness as the productivity of industries is greatly enhanced by state-of-the-art manufacturing technology and ICT, amongst others.

The market size itself is a contributor as well, as larger markets enable the exploitation of economies of scale. In today's global economy, no longer do the borders of a country alone define the size of the market, but international trade is taken into consideration as well. The 11^{th} meter of the GCI is business sophistication. It comprises the quality of a country's business network and the quality of an individual company's operations and strategies. This pillar is of most importance to countries that have efficiently exploited the other means of improving efficiency, usually ones in the advanced stages of development.

The last meter is innovation. It becomes extremely important when the benefits of current knowledge are exhausted, and competitiveness cannot be increased by taking up existing technologies. Innovations require investments in R&D, but they become necessary in order to gain a competitive edge when existing technology becomes broadly adopted. The competitiveness of different BSR^{-1} countries compared to the average GCI of Europe is illustrated in Figure 7. (WEF, 2018.)

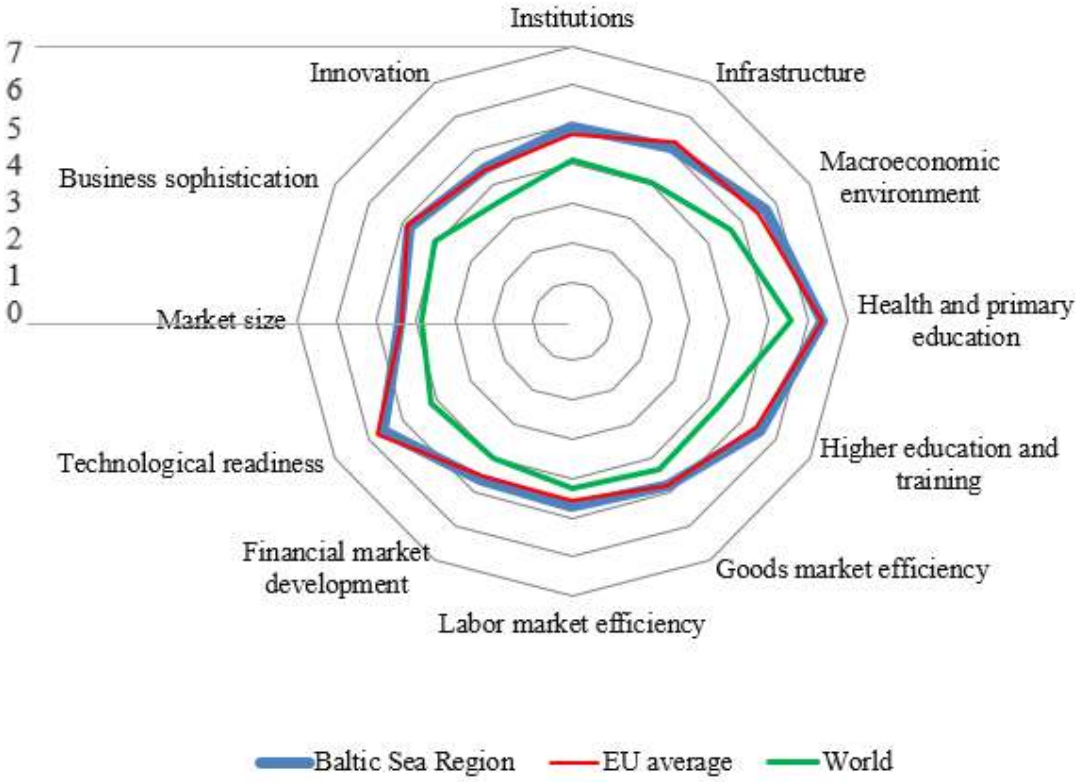

Figure 7 Comparison of the 2016–2017 Global Competitiveness Index between global, EU and BSR averages (WEF, 2018)

As seen in Figure 7, the EU and BSR^{-1} are almost on par for all 12 categories. They also rank well above the global average, as both the EU and BSR^{-1} comprise mostly advanced economies. Another similar index, the European RCI, uses almost identical categories to the GCI. However, unlike the GCI, it has separated primary education and health into their own categories, and it does not have a specific metric for financial market development nor for goods market efficiency. The averages for the BSR^{-1} countries and the whole of Europe are defined and compared in Figure 8. (European Commission, 2017b.)

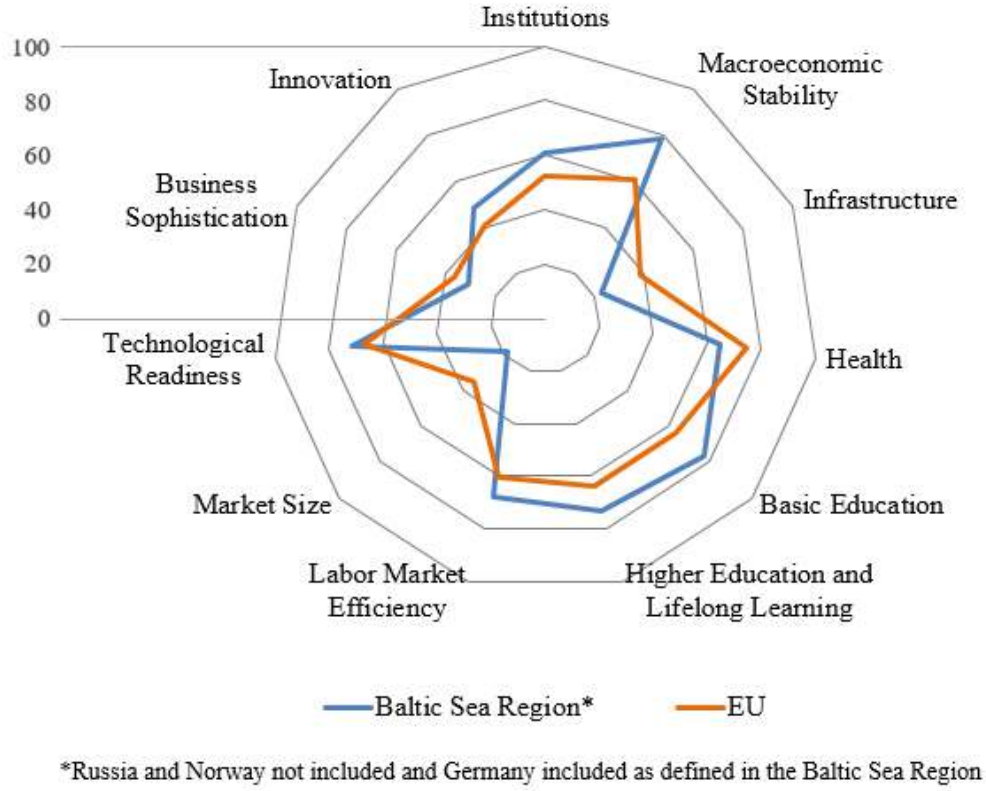

Figure 8 Comparison of the 2016 European Regional Competitiveness Index between averages for the EU and BSR countries (European Commission, 2016)

As seen in Figure 8, the BSR^{-1} seems to stand strong in education, productivity and economic stability. However, health, infrastructure, market size and business sophistication fall below the average for Europe. Health, infrastructure and business sophistication are lower in the Baltic countries and higher in the Nordic countries and Germany. The market size is below the average, with the competition being strong in large economies such France or the United Kingdom, or the rest of Germany not included in the BSR^{-1}.

Similarities can be found in the results of the GCI in Figure 7 and the RCI in Figure 8. Especially health and technological readiness seem to rank strongly in both. However, it is interesting that the GCI ranks the average for the BSR^{-1} as roughly the same as the average in Europe in every category, but this is not the case with the RCI. The average for the BSR^{-1} is stronger in seven categories than the average for Europe, but weaker in four. The differences result in part from Figure 8 omitting Russia and only including the BSR^{-1} parts of Germany, whereas Figure 7 includes both Germany and Russia in their entirety. To provide a clear comparison, the values of both indices with averages are presented in Figure 9.

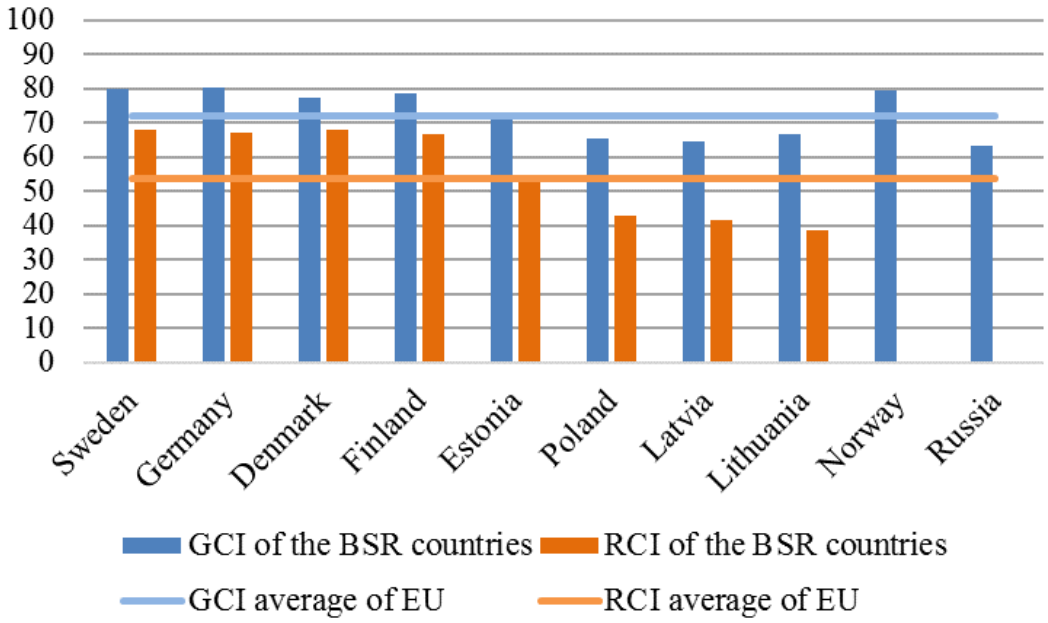

Figure 9 2016–2017 Global Competitiveness and the European Regional Competitiveness Indices of the BSR countries (European Commission, 2016; World Economic Forum, 2018)

It can be noted that the Nordic countries along with Germany rank noticeably high, standing above the average for Europe. Estonia barely exceeds the average, while the rest of the BSR^{-1} countries rank below it. This reinforces the other, similar, results of this thesis showing the division between west and east.

4.4 Transport and logistics in the region

According to Moraglio and Dienel (2015), transport has been one of the most important issues of the European socio-political debate post World War II. Freedom of movement of people and goods is one of the cornerstones of the EU and is essential for its self-representation and political legitimation (European Commission, 2018a; Misa & Schot, 2005). As the BSR^{-1} consists mostly of EU Member States or countries that are in close collaboration with the EU, any trends in the EU have a major impact on the BSR^{-1} as well.

The BSR^{-1} is a big regional player, even on the EU28 level. BSR^{-1} countries within the EU account for 27% of all 311 000 transport and logistic enterprises, 33% of the turnover of €450 billion, and 34% of the 10.5 million employees (Centrum Balticum, 2017). The current trends in the region include unification and ease of movement as well. The effects of liberalisation of trade and social and economic integration by the EU are not limited to the region; they have also affected the international demand for T&L services (BTO, 2011).

4.4.1 Forms of transportation

The Baltic Sea has always provided a natural platform for international trade within the BSR[-1]. The infrastructure for other forms of transport developed because of domestic demand. According to McKinsey and Company (2015), maritime freight, and especially container transportation, is the backbone of international trade. A vast majority of everyday products such as clothes and computers and a quarter of total dry seaborne trade is transported via containers. The situation is not that different in the BSR[-1]. International trade in the region has been plied by sea for centuries, and even to this day the Baltic Sea is one of the busiest seas in the world in proportion to its rather small size. A major share of trade in the BSR[-1] depends on shipping and has an important role in serving domestic transport as well. Twenty-four of the 94 Core TEN-T ports in the EU are located in the BSR, and annually they handle over 700 million tonnes of cargo and 50 million passengers (HAZARD, 2016). The impressive number of ports along the coasts of the Baltic Sea, with their annual freight volumes, are illustrated in Figure 10.

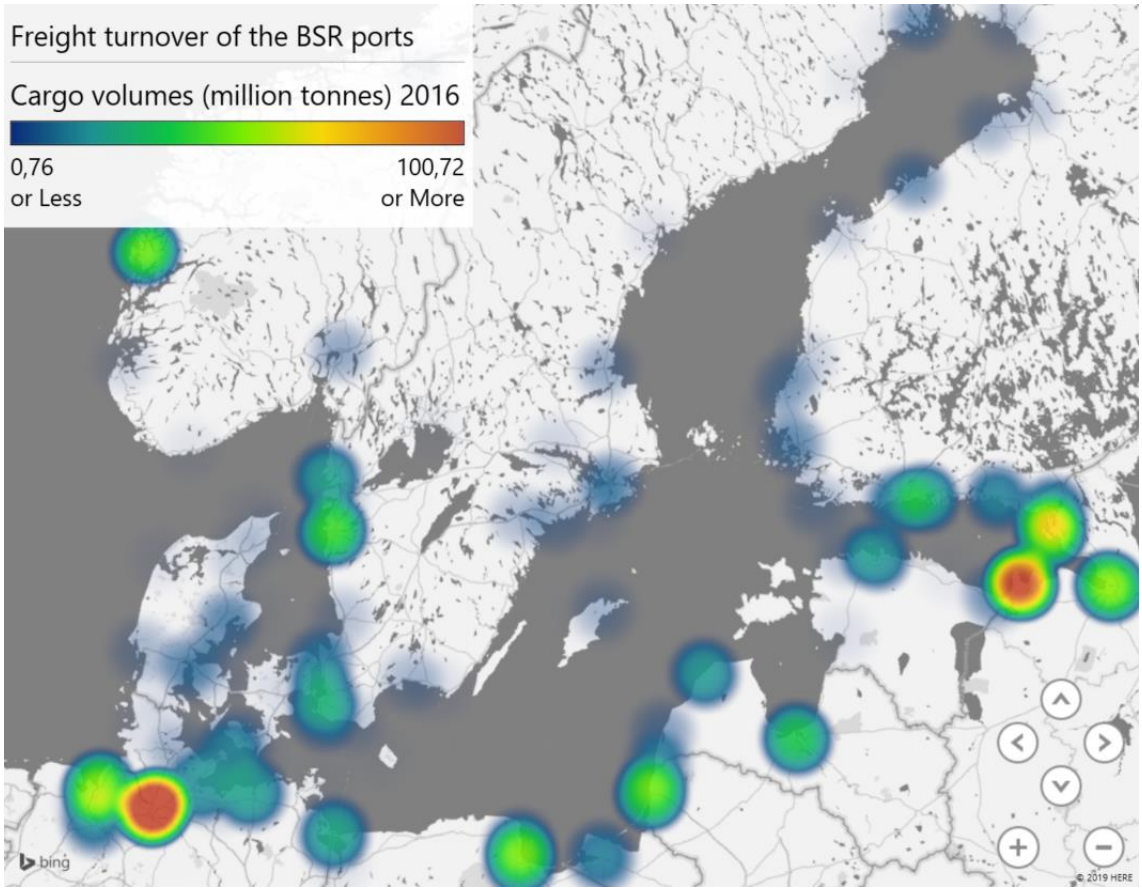

Figure 10 Port activity in the BSR in 2016 (Baltic Transportation Journal, 2018; Eurostat, 2018)

The heat map in Figure 10 illustrates where the ports are located on the shores of the Baltic Sea, and the importance of major ports especially in Germany, Denmark and Russia. A major share of all freight volumes are handled by these few large ports as illustrated in Figure 11.

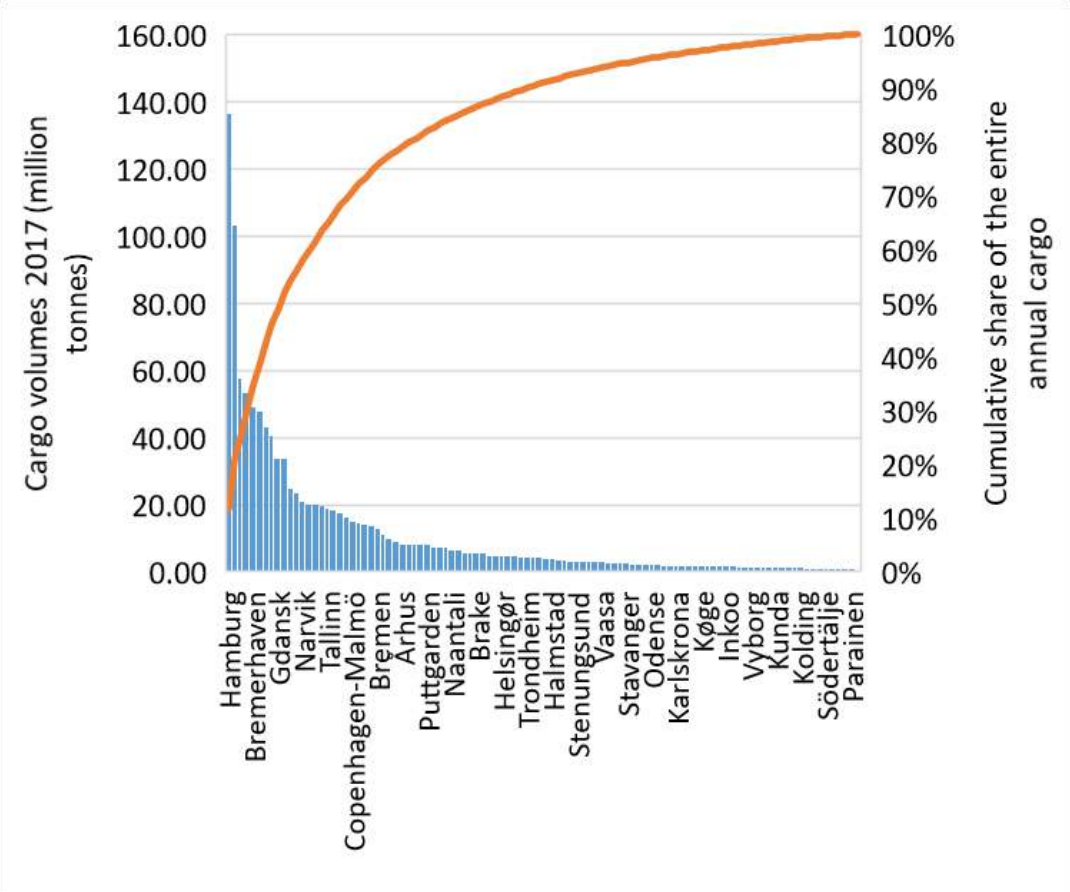

Figure 11 Share of cargo volumes handled by BSR ports (Baltic Transportation Journal, 2018; Eurostat, 2018)

As seen in Figures 10 and 11, cargo traffic in the BSR^{-1} is concentrated to a few large ports that handle the lion's share of the entire maritime freight traffic in the region. Only a few of the 102 ports in the region are listed in Figure 11, but the five largest in 2017 in terms of cargo volumes are, in descending order: Hamburg, Ust Luga, Primorsk, St. Petersburg and Bremerhaven. These five ports totalled roughly 35% of the entire cargo in 2017. Three of them are Russian and two German, stressing the importance of these countries in the BSR^{-1} economies.

In addition to the efficient movement enabled by the sea, crossing borders by land nowadays is extremely easy thanks to substantial improvements brought about by the Schengen Agreement. When it comes to land transportation in general, rail is more sustainable than road and for this reason is expected to be the backbone of intermodal and multimodal logistics. This will be increasingly important in the age of growing environmental awareness and regulation. However, road freight is most likely not going to disappear despite environmental pressure, as the reach of railways is always restricted by infrastructure (BTO, 2011.) The annual freight volumes for different transportation methods are listed in Table 5.

Table 5 Annual transportation figures for the BSR countries in 2017 (Baltic Transportation Journal, 2018; Eurostat, 2018; OECD, 2018; Russian Aviation, 2018; Unctad Stat, 2018)

Annual freight volumes in the Baltic Sea Region						
Country	**Total cargo turnover (million tonne kilometres)**		**Total cargo turnover (thousand tonnes)**		**Container port throughput (thousand TEU) (2017)**	**Merchant fleet National Flag (thousand DWT) (2017)**
	Rail freight (2017)	**Road freight (2017)**	**Air freight (2017)**	**Maritime freight (2017)**		
Denmark	2 575	15 502	236	94 558	820	17 212
Estonia	2 325	6 189	11	34 797	230	84
Finland	10 362	27 966	189	109 408	1 635	1 187
Germany	18 539*	51 727*	788*	54 453**	163**	1 738*
Lithuania	15 014	14 972	15	61 877	472	80
Latvia	15 414	39 099	21	52 913	450	165
Norway	4 040	21 385	169	200 143	827	21 495
Poland	54 797	335 220	121	78 437	2 385	106
Russia	245 315*	23 261*	111*	247 494**	2 235**	823*
Sweden	21 838	41 851	159	175 314	1 560	1 078
TEU = Twenty foot equivalent unit, DWT = Dead weight tonnage *Values have been weighted **German and Russian Baltic seaports only						

As seen in Table 5, the road and rail freight volumes are rather large. Domestic transportation relies on these two transportation methods in all of the BSR^{-1} countries, while maritime freight is responsible for the majority of international trade. Railways and roads play an important role in international trade as well, by transporting goods to and from ports. Some transportation is done via air freight, pipelines (especially Russia), inland waterways and between domestic maritime ports. The currently low air freight volumes could see growth with increasing wealth in the population and a consequent rise in numbers of people travelling. More passenger flights means an increase in air cargo capacity as well. Air freight is suitable especially for expensive low-quantity goods with low weight, when lead times in long-distance transportation are kept minimal. (WMRD, 2012.)

An additional aspect that is necessary to consider regarding the maritime routes of the BSR^{-1} is the seasonal need for vessels with ice breaking capacity. This region-specific need varies significantly as ice does not form, or does so in very small amounts, in certain areas. However, parts of the Baltic Sea can develop thick layers of ice for a large part of the year and these vessels are then crucial. Technological advances such as improved hull materials or entirely new innovations in the field could boost the efficiency of maritime traffic in the BSR^{-1}. (Baltice, 2018.)

4.4.2 Infrastructure

To be able to exploit the economic strengths of the BSR^{-1} with maximum efficiency, transportation networks require sufficient infrastructure. This is decisive for international, interregional and domestic trade and contributes to social cohesion. Transportation infrastructure comprises vital facilities such as railways, air- and seaports and roads. The supporting infrastructure also includes traffic control systems such as lights and communication, tracking and tracing, logistic hubs and energy facilities (European Commission, 2017b; European Commission , 2018b).

In the BSR^{-1} the construction and maintenance of infrastructure is done largely at national level, but partly on EU and BSR^{-1} level as well. Several projects created to reinforce transportation possibilities are, among others:

- TransBaltic (2009–2012)
- BSR Trans Governance (2013–2014)
- Scandria corridor (2009–2012)
- TEN-T (since 1990)

The largest of these projects, which is still ongoing, is the TEN-T, which often emerges in T&L related discussions within the EU. TEN-T is a vital part of the EU and hence BSR^{-1} transportation planning. It is part of a bigger system of Trans-European Networks (TENs) comprising the telecommunications network (eTEN) and energy network (TEN-E) in addition to TEN-T. (Moraglio & Dienel, 2015)

National transportation in the BSR^{-1} relies heavily on road and rail infrastructure, with some freight moving through inland waterways and from one domestic port to another. Urban planning also plays a role in the efficiency of the logistics, as the accessibility of vehicles varies greatly in different corridors. Accessibility on an international scale is limited mostly by border

controls, low demand for transport in remote areas, insufficient infrastructure (bottlenecks, missing links etc.), and interoperability problems for freight rail services and passengers. The differences in railways are greatest between eastern and western parts of the BSR^{-1}. Integrating them fully would be costly, which is most likely why it has not been realised. National differences exist in at least signalling, gauges and the supply of electricity. (BTO, 2011; Lindholm & Behrends, 2012.)

According to the European Commission (2018b), the condition of the infrastructure in the EU is evolving but still lacks in some respects. It faces challenges in areas such as governance, pricing (taxation and financing), intermodality and integration of different systems, optimisation of the lifecycle, and infrastructure operation. Moraglio and Dienel (2015) argue that the T&L sector requires investments in the infrastructure, which the EU struggles to provide. This is backed up by Julsrud and Uteng (2015), who argue that despite the large investments made through the TEN-T network, the T&L sector still lacks sufficient funding to answer all the needs.

4.5 Interconnectedness

As discussed earlier, cooperation between the BSR^{-1} countries has been close and the region seems somewhat unified. The connectedness between the countries was studied further by collecting data from Unctad Stat as shown in Table 6.

Table 6 The five largest trade partners of each BSR country by export values (Unctad Stat, 2018)

Top 5 trade partners of the Baltic Sea Region countries in 2017 (exports, million USD)																			
Country	**Germany**	**USA**	**Sweden**	**UK**	**Netherlands**	**Russia**	**France**	**China**	**Norway**	**Finland**	**Latvia**	**Belarus**	**Turkey**	**Czechia**	**Italy**	**Denmark**	**Lithuania**	**Poland**	**Estonia**
Germany		126 360		94 819	91 278		118 773	97 774											
Sweden	16 351	10 078							15 432	10 517						10 441			
Russia	25 729				35 611			38 904				19 385	18 206						
Norway	15 823		6 739	21 523	10 135		6 570												
Finland	9 399	4 364	6 855		4 480	3 796													
Latvia	944		805			1 178											2 165		1 491
Denmark	14 517	4 456	10 856	7 538					5 901										
Lithuania	2 189	1 553				4 471					2 967							2 424	
Poland	60 210			14 071			12 343							14 052	10 856				
Estonia	1 053		1 954			1 579				2 338	1 322								

As seen in Table 6, the connections between the BSR^{-1} countries are strong. Each of the region's countries appears at least once as one of the five top trading partners of another BSR^{-1} country; Germany stands out in being linked to every one of them. Additional notable trade partners appear to be the United States of America (USA), United Kingdom (UK), Netherlands, France and China. The high ranking of the USA and China also illustrates the significance of global trade to the BSR^{-1} despite the region's apparently strong interconnectedness.

Several indices also exist for measuring the connectedness of a country. The Logistics Performance Index (LPI), which compares the logistics performance of different countries, has been published by the World Bank since 2007 (Arvis et. al. 2018). The LPI is based on a survey in which logistics experts from around the world evaluate a country's logistics performance based on the following six criteria:

- The efficiency of customs and border management clearance
- The quality of trade- and transport-related infrastructure
- The ease of arranging competitively priced international shipments
- The competence and quality of logistics services
- The ability to track and trace consignments
- The frequency with which shipments reach consignees

Another index, the Liner Shipping Connectivity Index (LSCI), measures logistics performance from the perspective of maritime connectedness. The higher the score, the better the accessibility and the higher and more effective the traffic flows. The average aggregate LPI score of the EU countries from 2012–2018 was 3.6 (scale 0–5) and the average LSCI 51.1 (scale 0–100). The LPI and LSCI are illustrated in Figure 12.

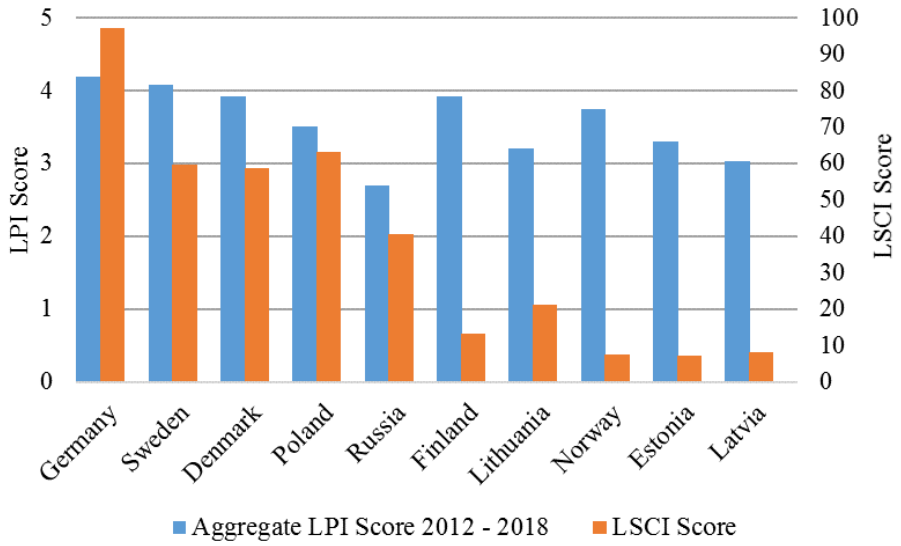

Figure 12 Liner Shipping Connectivity Index (LSCI) and aggregate Logistics Performance Index (LPI) scores of the BSR countries (Arvis et al., 2018; UNCTAD Stat, 2018)

As shown in Figure 12, the differences between the LPI and LSCI scores are quite significant. The deviation of the LSCI score is rather large, whereas the LPI scores do not significantly differ between the countries. Germany ranks number one worldwide on the LPI score, with the Nordic countries close behind. All of the western BSR^{-1} countries exceed the average for the EU, while the eastern countries fall a little short of that standard. The LSCI scores are rather low for most countries, but Germany again ranks extremely high thanks to its major global seaports. Especially Finland, Norway, Estonia, Latvia and Lithuania rank poorly on the LSCI scale. (Arvis et al., 2018; UNCTAD, 2018)

4.6 Regional security and stability

In general, the regulation of working conditions and transportation is very strict within the EU, and hence in the BSR^{-1} as well. Both work- and transportation-related accidents are low in number. Theft and other crimes are uncommon due to low levels of corruption, reliable police forces and good transparency. However, the operations are still far from perfect. The technological development and especially innovations such as the IoT open up new possibilities for hybrid threats (Cederberg et al., 2017). Safety and security must be continuously reviewed and improved through projects such as HAZARD. (European Commission, 2019; HAZARD, 2016.)

The low levels of corruption in the BSR^{-1} are illustrated in Figure 13, which shows the Corruption Perceptions Index (CPI) of the BSR^{-1} by comparing the countries against averages for the EU28 and the whole of Europe.

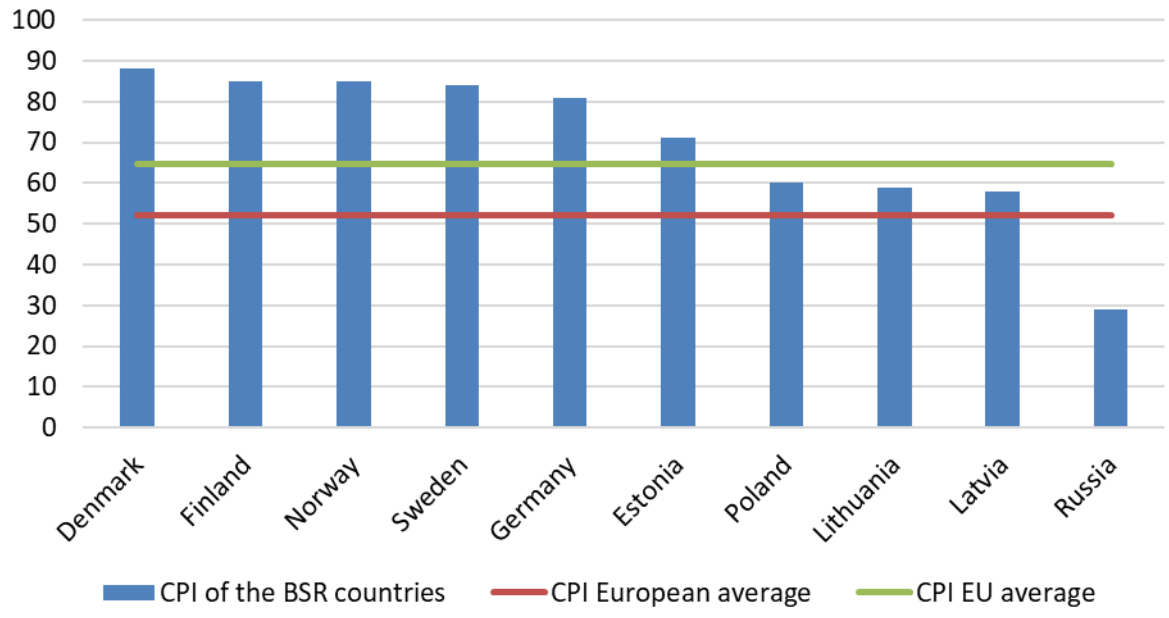

Figure 13 Corruption Perceptions Index 2017 (Transparency International, 2018)

In the CPI, a higher ranking signifies better transparency and lower levels of corruption, ergo the higher the score the better. The Nordic countries within the BSR^{-1} were all within the top 10 ranking countries in 2017. As seen in Figure 13, Germany and Estonia, along with the Nordic countries, are positioned above the averages for both Europe and the EU. Featuring both averages shows that Poland, Lithuania and Latvia are stationed below the EU but exceed that for Europe. The only BSR^{-1} country ranking below the European standard is Russia, which scores significantly lower than the other countries in this comparison.

5 METHODOLOGY

5.1 The Delphi method

The empirical part of this research used the Delphi method. Mullen (2003) argues that there is a danger of narrowing the definition of Delphi too much, as the method is highly versatile. Even with the few defining characteristics there are still a myriad of different ways of bringing the method into practice. There are no clear delimitations to hinder the research, which is beneficial, as different settings require different approaches, and the method should be tailored to fit the varying needs of different studies. However, because of the vague definition of the method, it is important to clarify the way it is applied in research. As concluded in Chapter 2, the Delphi method was found to be the most suitable approach for this thesis; hence the details of how it was conducted are discussed below.

According to Mullen (2003), a Delphi study typically involves a structured or partly structured questionnaire that is sent out to a panel of experts. A structured questionnaire was used in this thesis. A Likert scale[8] with five ordered response levels was used, with the sixth option of "no opinion" also being available as well for each question. An exception was Question 42, which asked the participants to estimate achieved GHG reductions in the future, as all the response options were given as percentages above zero.

The survey questionnaire was based on the preceding Delphi study from 2013. A literature review was conducted on existing foresights for the T&L sector, and on existing statistics and literature regarding the T&L sector specific to the BSR^{-1}. The final questionnaire was refined by a group of researchers to ensure that the focus would stay on the relevant topics. The existing questionnaire from the studies by Ojala et al. (2013) and Leino (2014), used as the framework for the questionnaire in this research, was modified as follows:

- A question related to the political situation in 2013 was removed as it had been answered by the time this research was conducted.
- The remaining questions were slightly tweaked by adding minor changes to the tone of some of the questions and changing the year of the questions from 2025 to 2030.
- Nine new questions were added.

[8] Equally distributed set of negative and positive statements. Typically, respondents select one of five responses. (McIver & Carmines, 1981)

5.2 The PESTE themes

The structure was built around two different frameworks. The first, created right at the start of the study, gave structure to the report and the initial questionnaire. It was built around the PESTE themes as illustrated in Figure 14.

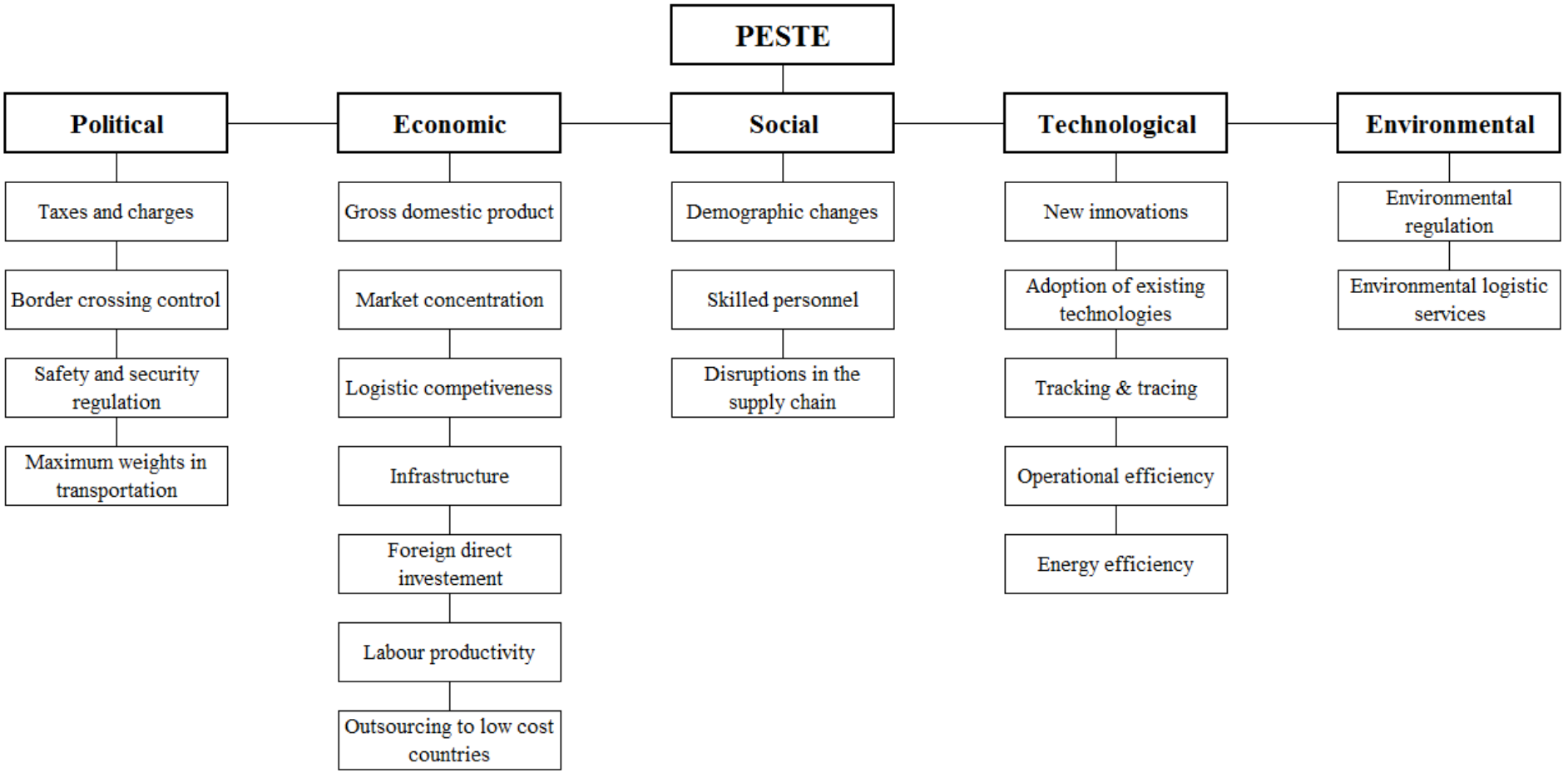

Figure 14 PESTE framework for the Delphi questionnaire

The different aspects of the study were laid out under the PESTE themes Political, Economic, Social, Technological and Environmental. PESTE was seen as an important framework as it had been used in the preceding studies on this same topic, and the structure was aimed to be kept similar. However, for the survey the aim was to create a structure that is simpler and easier for the responder to avoid any confusion. Hence, the following 10 themes were created:

1. Competitiveness of the transport and logistics sector
2. Road freight transport and logistics
3. Rail freight transport and logistics
4. Air freight transport and logistics
5. Maritime freight transport and logistics
6. Advanced logistics services
7. Transport and logistics related technology
8. Environmental aspects related to transport and logistics
9. Social aspects related to transport and logistics
10. Supply chain safety and security

The 52 questions in the survey were classified under these themes and can be viewed in Chapter 6, which introduces the results.

5.3 Data collection

The survey was conducted in two rounds using the web-based survey platform Qualtrics. The two rounds of the Delphi took place in late 2018 and early 2019. In total, 135 experts were invited to participate in the survey. In the first round, 98 responded, of which 96 (71% of the invited amount) responded to the second round as well. Only the answers of experts who participated in both rounds are considered in the results. Figure 15 reveals the response percentage and number of respondents by BSR^{-1} country.

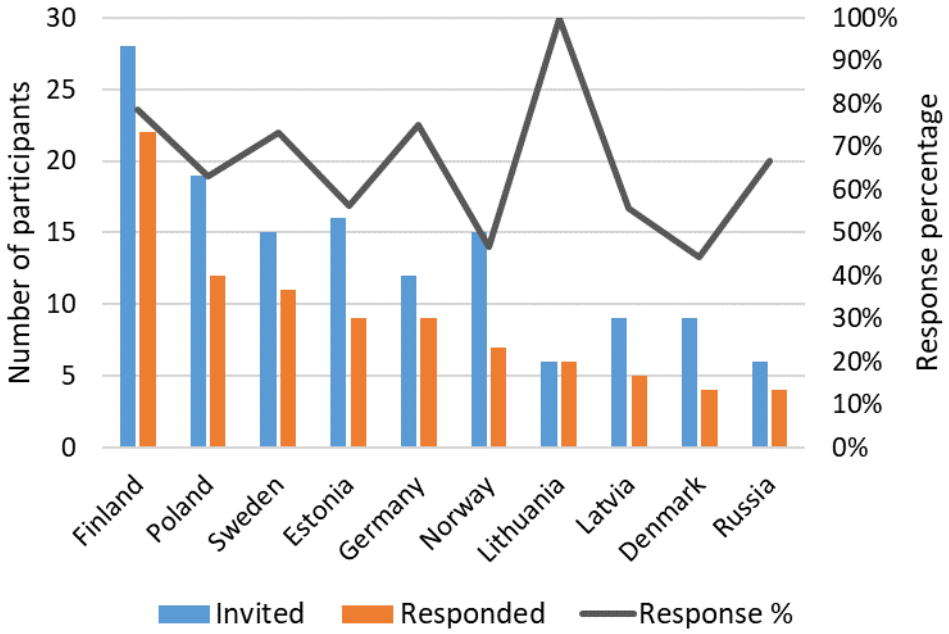

Figure 15 Respondents to the Delphi survey by current country of residence

Figure 15 shows that each country of the BSR^{-1} was represented in the panel, with a minimum of four respondents from each country. The lowest number of responses came from Denmark and Russia with four in both, while the largest number was received from Finland with 23 responses. Many of the respondents were experts at European or BSR^{-1} level in addition to their current country of residence, which adds to the collective knowledge of the panel.

Hsu (2007) argues that one of the risks of the Delphi method is that experts may not have sufficient knowledge to answer a particular question, and it may not become apparent. To avoid this, the respondents were asked to rank their expertise in each subject. The results, presented in Chapter 6, are weighted with the given levels of expertise to reduce the significance of inexpert answers, particularly as the questionnaire was large with multiple themes and not every respondent can be an expert in everything. With weighting, the results better describe what they are meant to measure, and respondents with better knowledge of a certain topic are better represented in the end-results than those who ranked their expertise lower. Figure 16 illustrates the level of expertise for each theme.

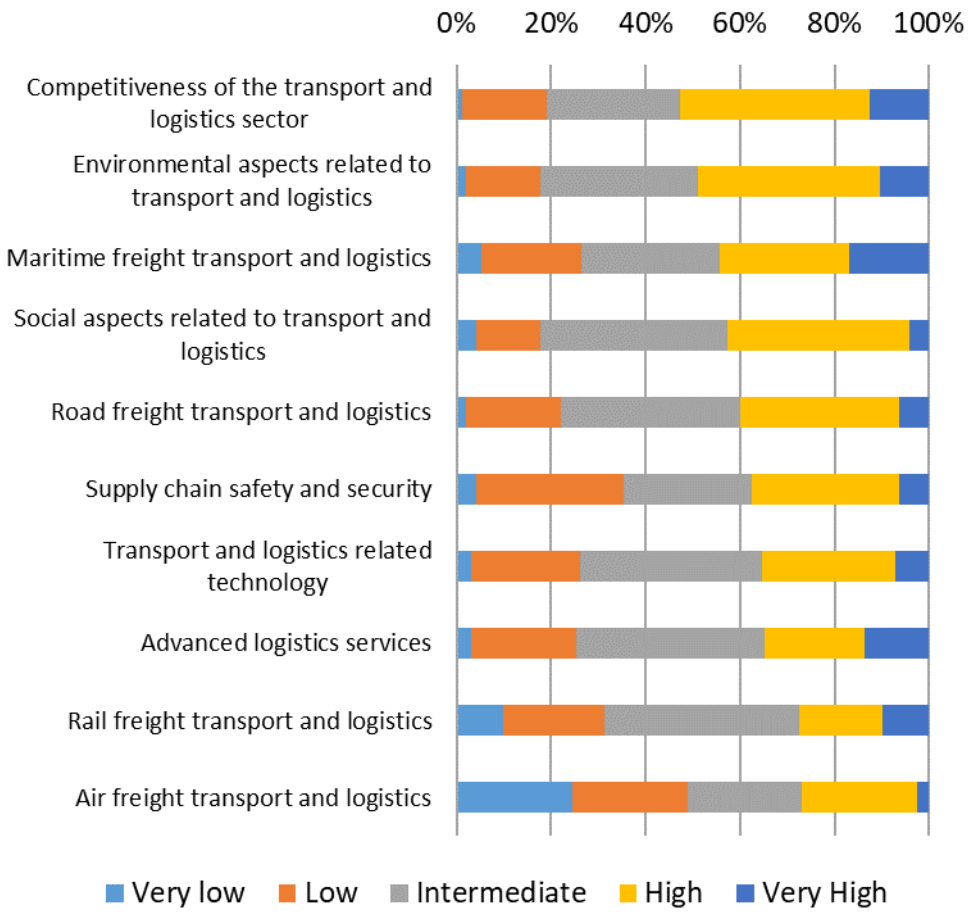

Figure 16 The self-rated expertise of the panel by theme

The themes in Figure 16 are ranked from largest to smallest by summed-up share of high and very high levels of expertise. Expertise was estimated to be very strong in the competitiveness of the transport and logistics sector, and only here did the summed share of high and very high expertise exceed 50%. These expertise levels stayed at over 20% in all but the air freight transport and logistics theme. It is also the only theme where the added share of intermediate, high and very high levels of expertise stayed under 50%. Supply chain safety and security was very evenly distributed between high and low expertise levels, with the intermediate level being the lowest here. For validity's sake, it is positive that most of the strongest statements and major findings of this thesis are from the top five highest expertise themes.

6 RESULTS

Chapter 5 discussed the methods used in the gathering of data and the structure of the survey. In this Chapter we examine the results by first reviewing the scores of the questionnaire, followed by the results of an independent sample t-test on the differences between BSR^{-1} east and west respondents.

6.1 Survey scores in general

The studies by Ojala et al. (2013) and Leino (2014) discuss the state of T&L in the BSR^{-1} in 2025, while this thesis studies the same topic but with the foresight extending 5 years later to 2030. Much can change in 5 years in a large multinational environment such as the BSR^{-1}. Hence, the results of the two Delphi studies were compared. The arithmetic mean and standard deviation of the answers from both forecasts are illustrated in the following figures. The questions are shown on the left and the response options for each numbered question at the top. The responses are positioned such that a higher score signifies positive expectations for the future in regard to the question and the T&L sector of the BSR^{-1}. Questions 48–52 in Figure 29 (Safety & Security) are an exception, with a higher score depicting a negative outlook.

The total average score of the entire questionnaire was 3.62, which serves as a comparison point to see how the responses in a certain theme did overall. Some questions in the figures do not have the 2025 answer bar, which means that the question was not included in the previous study.

6.2 Theme 1: Competitiveness of the transport and logistics sector

The first theme in the survey comprises questions regarding the significance of the T&L sector for the competitiveness of the BSR. These questions are illustrated in Figure 19.

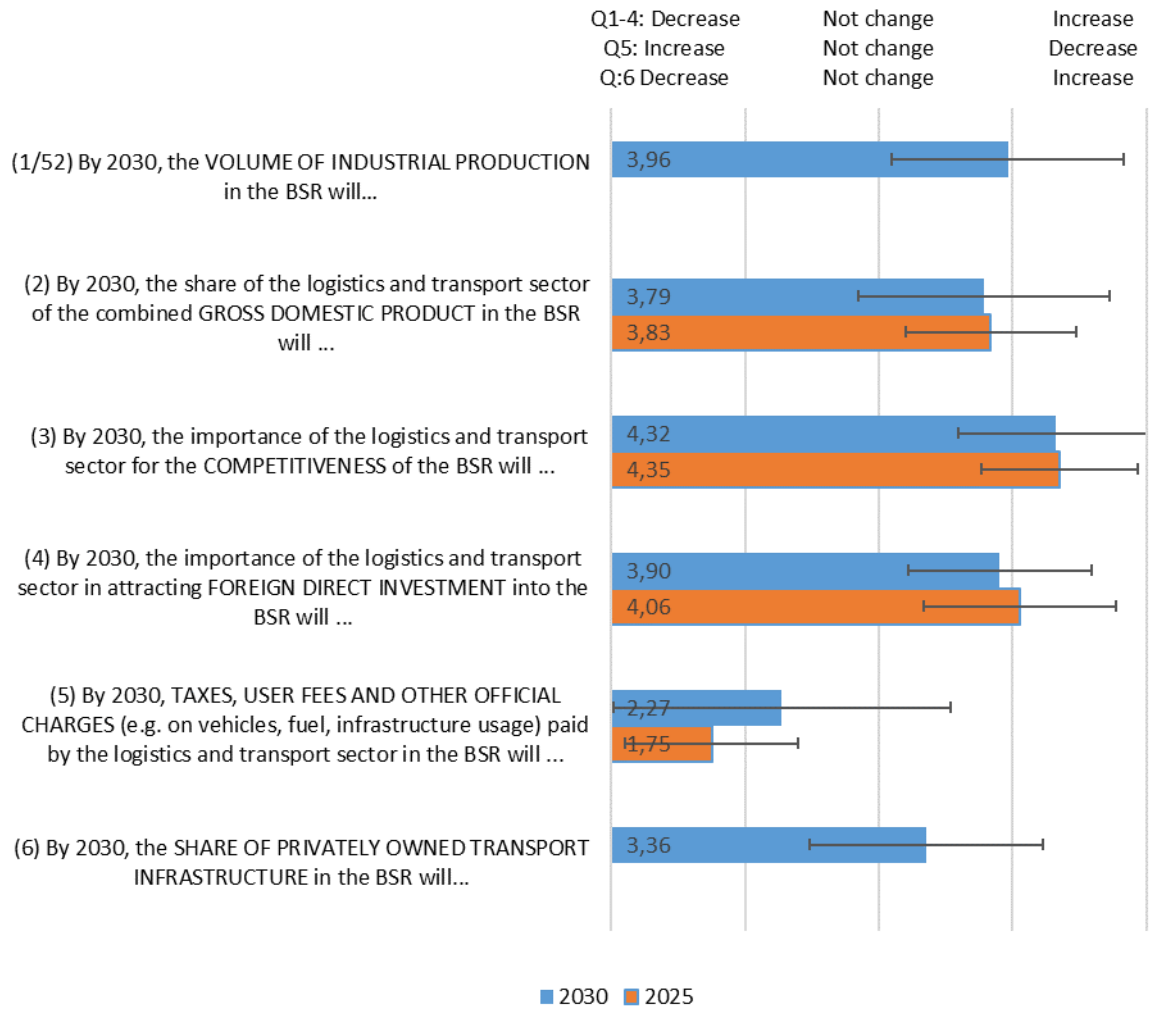

Figure 17 Theme 1: Competitiveness of the transport and logistics sector (N = 96)

The results illustrated in Figure 19 reveal that industrial production is expected to rise in the coming years. The importance of T&L is magnified in questions 2–4, which show expectations that it will increase in terms of GDP, competitiveness, and foreign direct investment (FDI). Taxes and other official costs are expected to cause increasing costs in the future, even if this view is not as drastic as it was in 2025.

6.3 Theme 2: Road freight transport and logistics

The second theme looked into the future of road freight in the BSR[-1]. The results are shown in Figure 20.

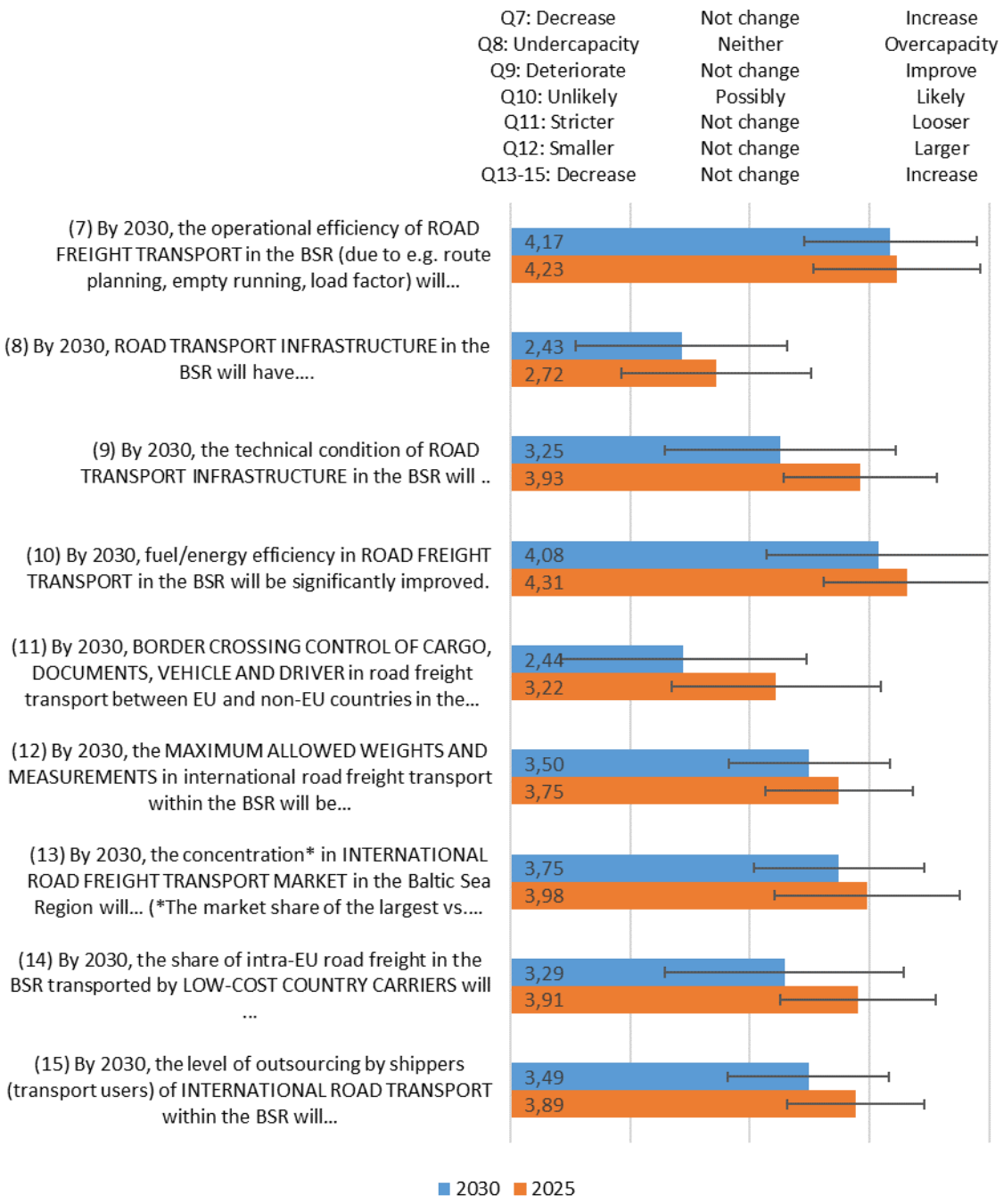

Figure 18 Theme 2: Road freight transport and logistics (N = 95)

Generally, the views seem to be positive when it comes to road traffic. Efficiency, technology and infrastructure are all expected to see changes for the better, and the BSR^{-1} is expected to rise in importance. The only categories that rank below the midline are questions 8 and 11, one regarding road infrastructure use and the other border crossings between EU and non-EU countries. The shift in question 11 from earlier years is the largest in the entire questionnaire and most likely reflects the tense political situation between the EU and Russia.

6.4 Theme 3: Rail freight transport and logistics

Theme 3 is rail freight T&L. The results are shown in Figure 21.

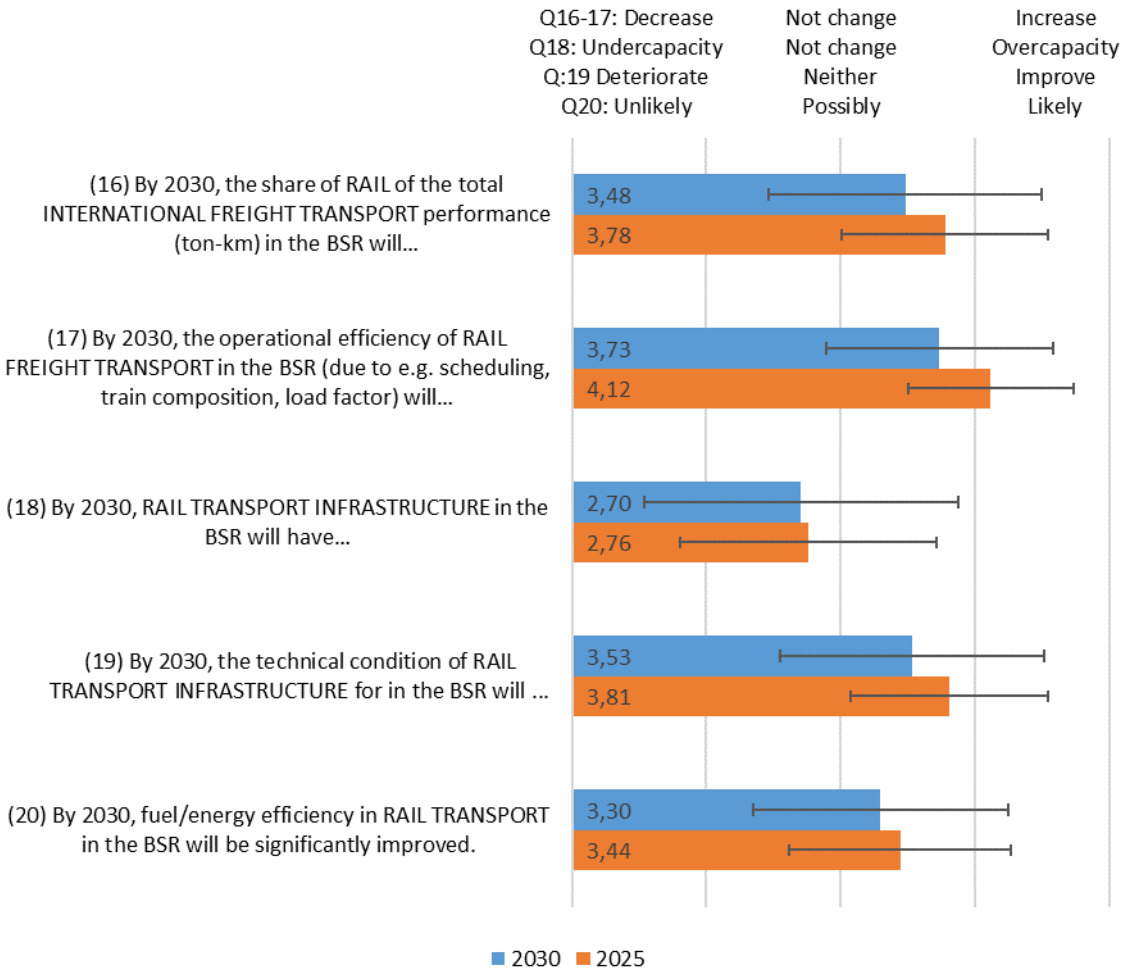

Figure 19 Theme 3: Rail freight transport and logistics (N = 95)

Only question 18 within this theme ranks in the lower half of the score spectrum. Like in the road traffic theme, the infrastructure is expected to have a slight undercapacity. The remaining questions anticipate a positive change, even if not very drastic, as all these scores position between three and four. No significant change is seen between the 2025 and 2030 surveys.

6.5 Theme 4: Air freight transport and logistics

Theme 4 is about air freight, one of the less well-known themes among the expert panel of this survey, as seen in Figure 22.

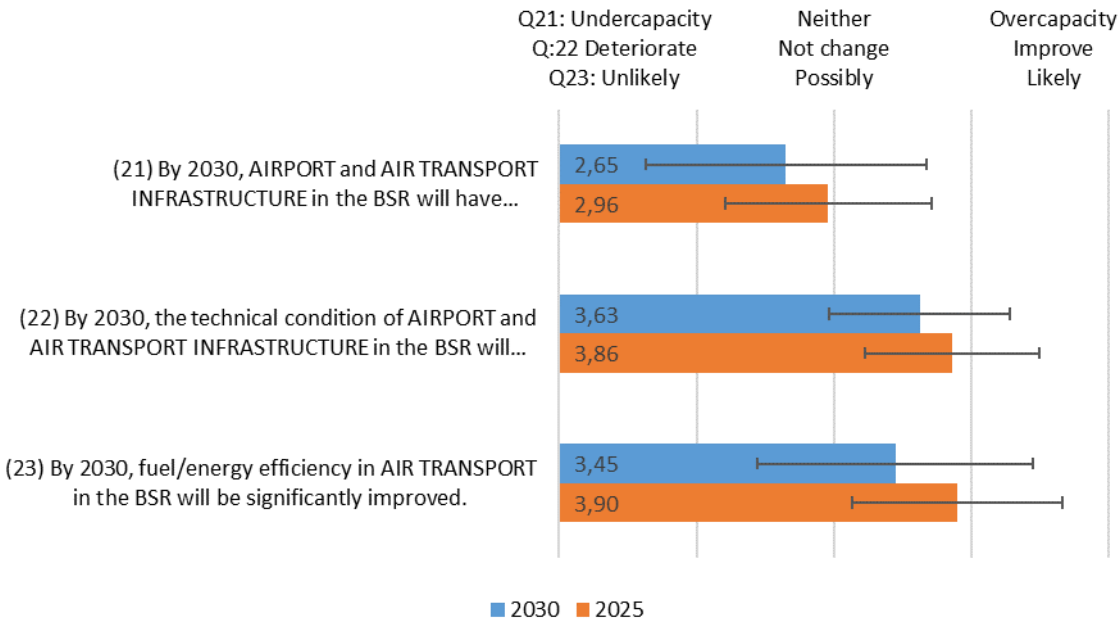

Figure 20 Theme 4: Air freight transport and logistics (N = 94)

As with the previous questions on infrastructure capacity, some undercapacity is expected in the future. Technical condition and fuel efficiency are expected to see a minor improvement.

6.6 Theme 5: Maritime freight transport and logistic

The fifth theme looks into maritime freight, a theme with the highest number of “very high” level experts on the panel. The results are shown in Figure 23.

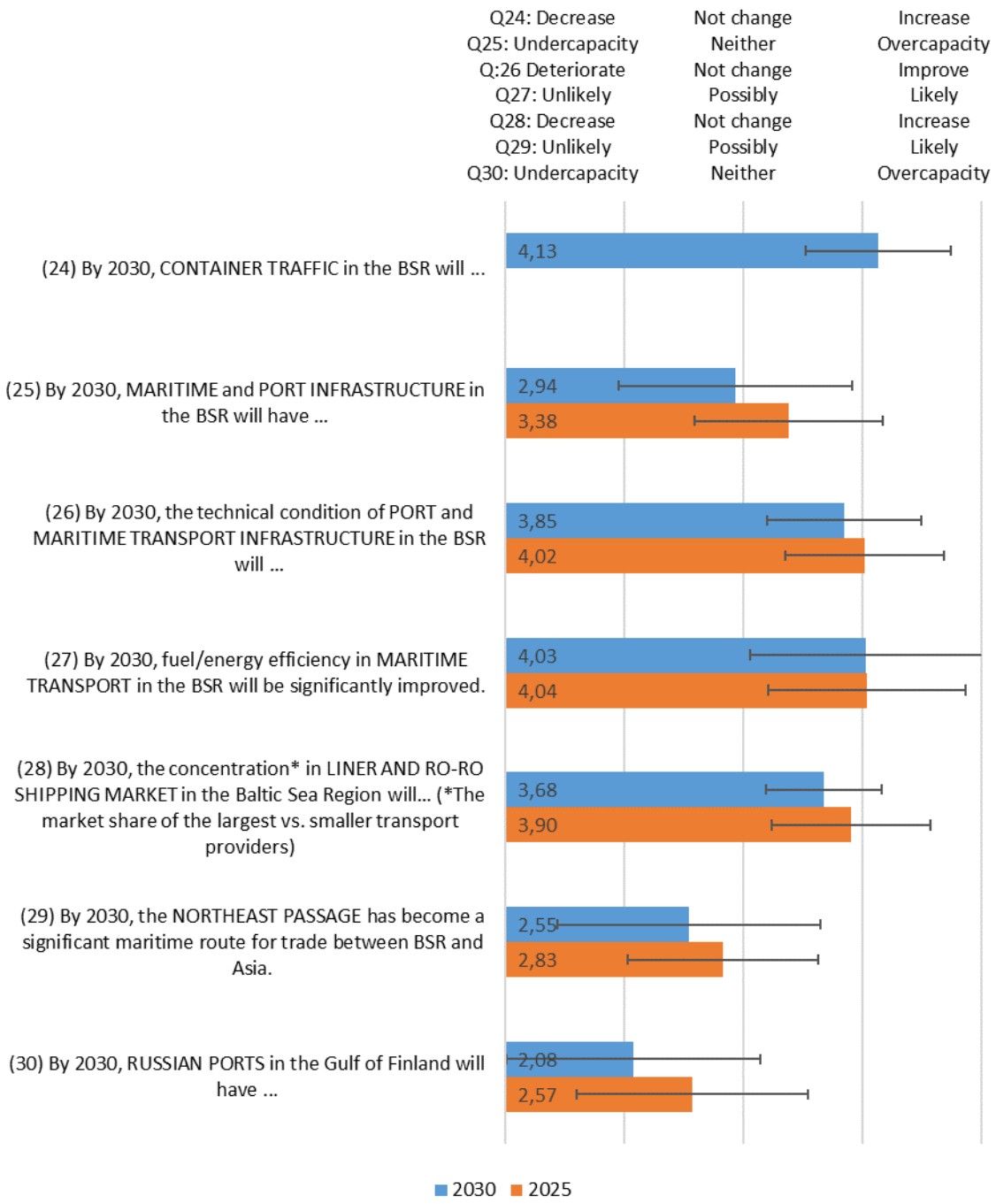

Figure 21 Theme 5: Maritime freight transport and logistics (N = 94)

Again, the majority of questions scored above average. As with the other transportation modes, some undercapacity in the infrastructure is anticipated. Another question that received a rather low score is number 29. The rise of the Northeast Passage as a significant route is not expected to be likely. Generally, in this theme the views are now slightly less optimistic than they were in the preceding study.

6.7 Theme 6: Advanced logistics services

The sixth theme was about advanced logistics services. The results are shown in Figure 24.

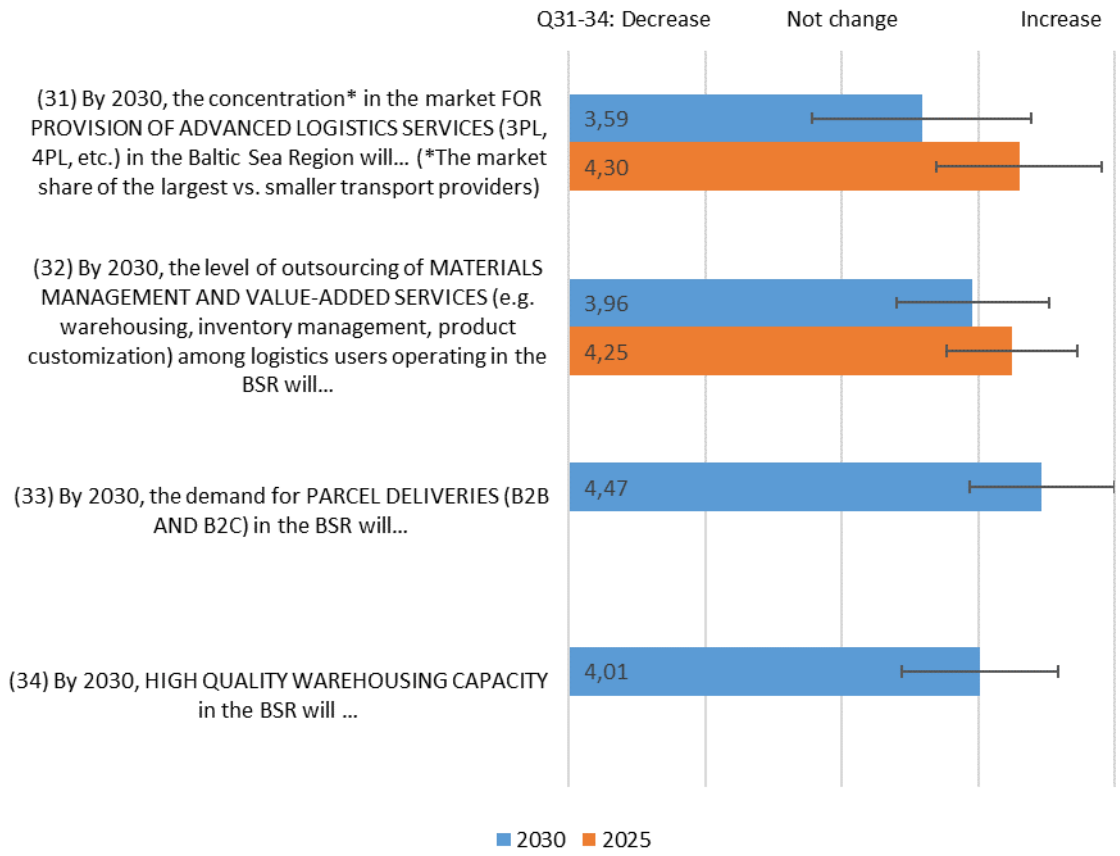

Figure 22 Theme 6: Advanced logistics services (N = 95)

On average, theme 6 ranked the second highest of all ten. All the scores are above three, and especially the demand for parcel deliveries is expected to peak by 2030. We can also see that the concentration of advanced logistics services is expected to increase significantly more than was anticipated in the preceding study.

6.8 Theme 7: Transport and logistics related technology

Theme 7 is T&L related technology and the results are shown in Figure 25.

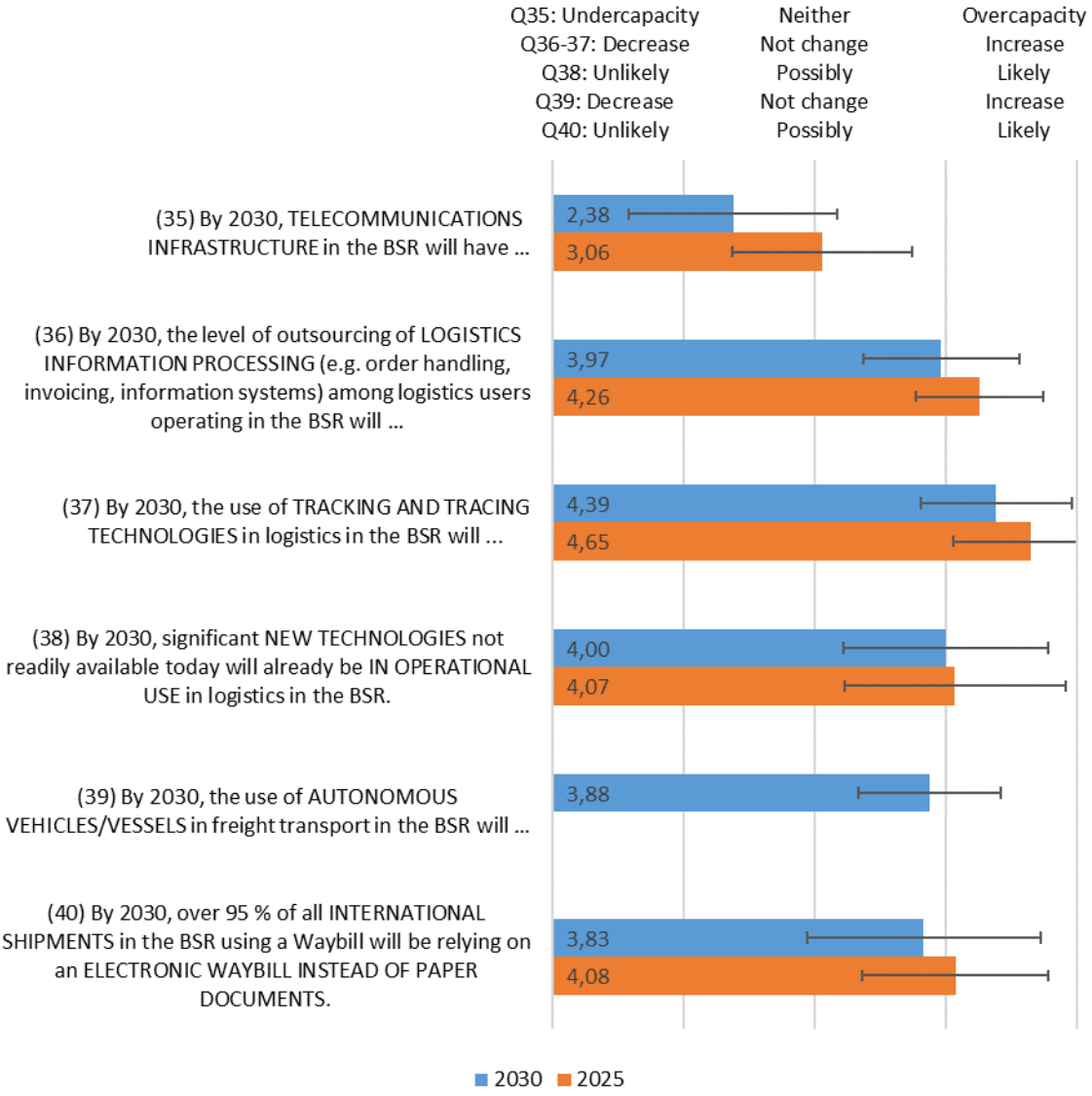

Figure 23 Theme 7: Transport and logistics related technology (N = 95)

Figure 25 mostly portrays a positive array of results. The one low score, question 35, is, however, forecasting possible undercapacity in the telecommunications infrastructure by 2030. This expectation has changed quite significantly from the preceding study.

6.9 Theme 8: Environmental aspects related to transport and logistics

Environmental aspects, theme number 8, is illustrated in Figure 26.

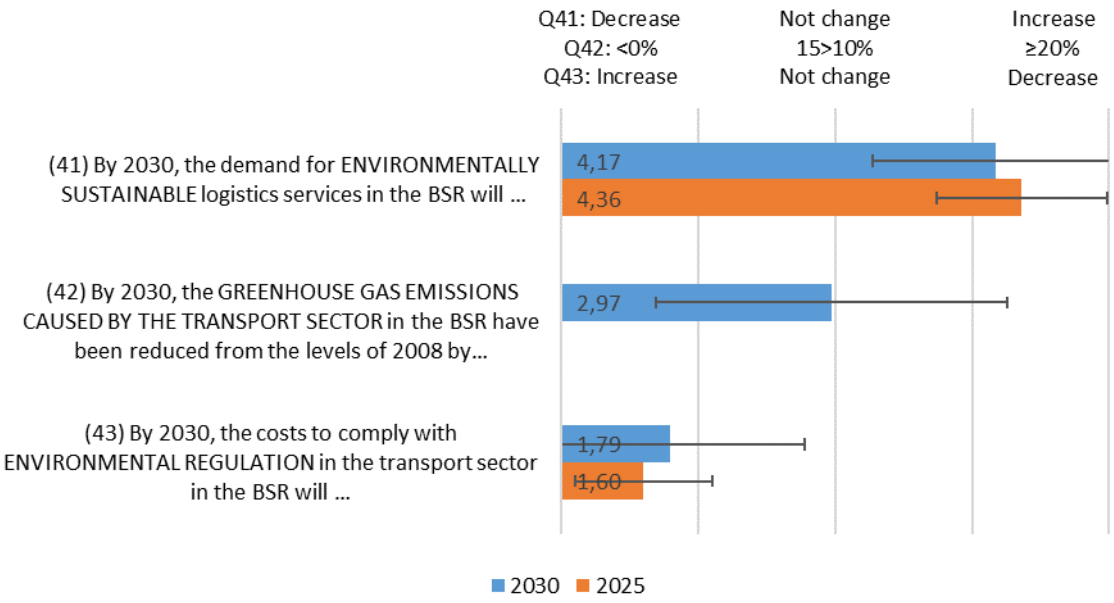

Figure 24 Theme 8: Environmental aspects related to transport and logistics (N = 95)

The results in this theme paint a grimmer image than average in this study. Especially the costs of complying with regulation are expected to rise, leading to greater demand for environmentally friendly services as well. However, a 10–15% reduction in GHG emissions is anticipated. The average response does not significantly differ from the preceding study. Figure 27 shows the results of theme 9, which is about the social aspects of T&L.

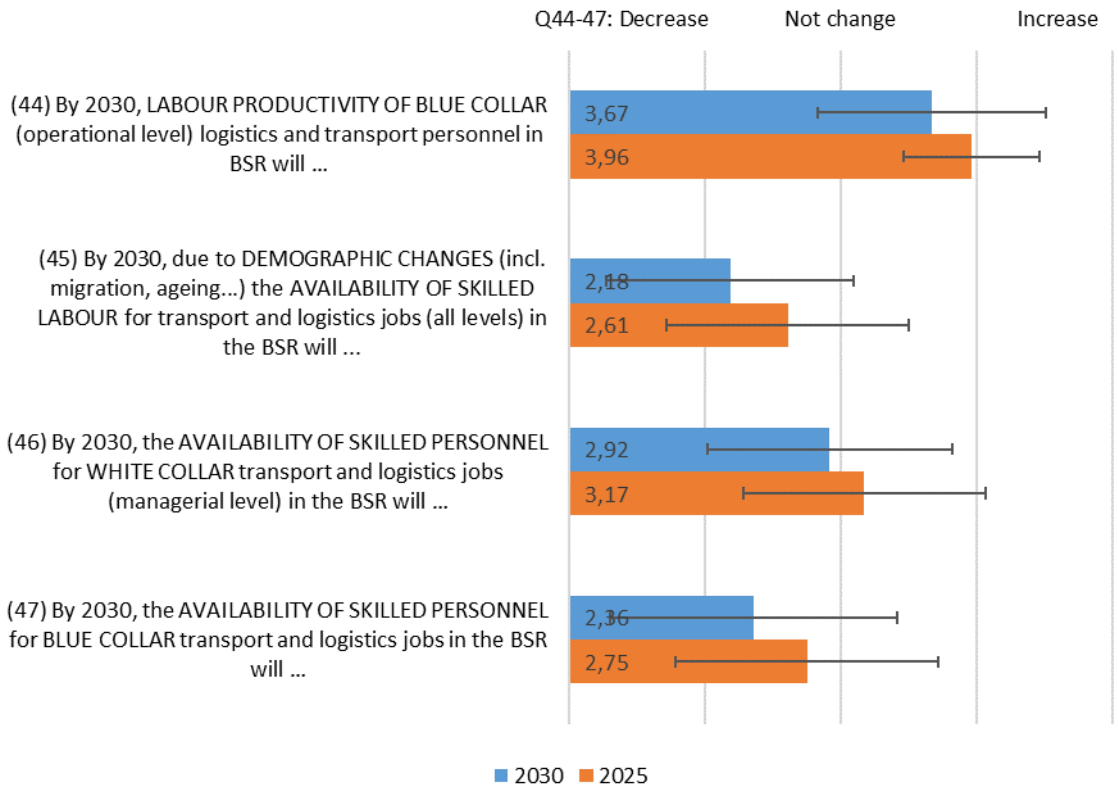

Figure 25 Theme 9: Social aspects related to transport and logistics (N = 93)

The results are again at the lower end of the scores, as the total average response in the survey was 3.62. Especially the availability of blue-collar workers is expected to be rather scarce by 2030, and notably more so than in the preceding study.

6.10 Theme 10: Supply chain safety and security

The final theme, supply chain safety and security, is illustrated in Figure 28.

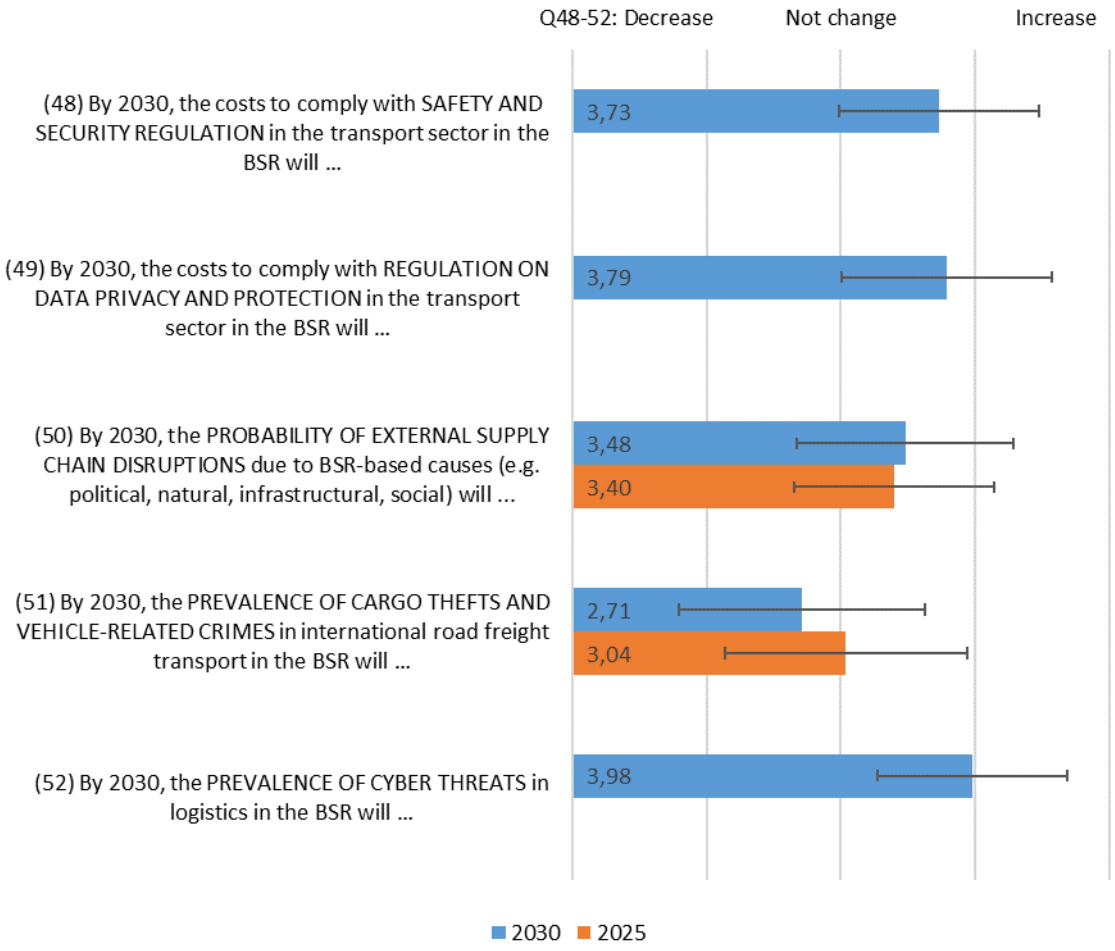

Figure 26 Theme 10: Supply chain safety and security (N = 92)

According to the survey, the safety and security theme in general did not fare too well. In this category, unlike in the others, a higher score signifies worse outlooks. The costs are expected to increase, and especially the prevalence of cyberthreats is expected to rise in the future. Most questions in this category are new, and no drastic changes are seen compared to the preceding study in the others. When this category is later viewed against the others, the scores will be reversed (to have a higher score signifying a more positive outlook) to make the comparison easier.

7 DISCUSSION

Both the literature and the conducted Delphi study anticipate that the BSR will face multiple intra- and interrelated changes in the coming decade. The major findings on a global scale are that technologies such as alternative fuels, advanced predictive analytics, automation etc. discussed in the literature review of this thesis will play an important role in future T&L (PWC, 2019; DHL, 2016b; Cederberg et al., 2017). The individual effects of one technological possibility are debatable and hard to forecast, but together they pave the way for a new era of logistics.

The results of the Delphi survey forecast that this revolution of unseen technological advancements will have its effects in the BSR^{-1} as well. The environmental movement to battle climate change is strong and present in the T&L industry (and in other sectors) worldwide, and for now it seems that the regulations are only going to get stricter over time and the demand for green services will ever increase (DHL, 2013b). Both the literature and Delphi survey provided results that fortify this view, and the BSR^{-1} is expected to witness this lasting spring of green movements alongside the rest of the world (European Commission, 2011; European Commission, 2017a).

According to Henningsen et al. (2017), and as discussed in the literature in Chapter 4.1, there has been friction between western and eastern BSR^{-1} countries throughout history. The situation has improved tremendously since the cold war, but a certain division has still prevailed. The former “east” countries of the BSR^{-1} have identified more as western, and the old differences from the cold war era are becoming less relevant.

The last few decades have shown signs of possible further cooperation, but the aggressive foreign policy of Russia has damaged the sense of unity in the region. Future development in this regard is difficult to foresee, as it is dependent on a myriad factors, but the levels of cooperation and trade between Russia and the rest of the BSR^{-1} countries risk getting worse in the future. The topic was indirectly addressed in the Delphi study, and the largest deterioration from the scores of the preceding study throughout the survey was in the anticipated difficulties in border crossing controls between EU and non-EU countries, most likely pointing to this problematic relationship.

7.1 Key findings of the Delphi study

The combined results of the Delphi study are illustrated in Figure 29. The results are presented per theme and are weighted with the expertise levels of the panel. The scores of the safety and security theme are reversed here in a similar manner as in the statistical analysis (to have a more positive value signifying more positive outlooks) to make the themes comparable.

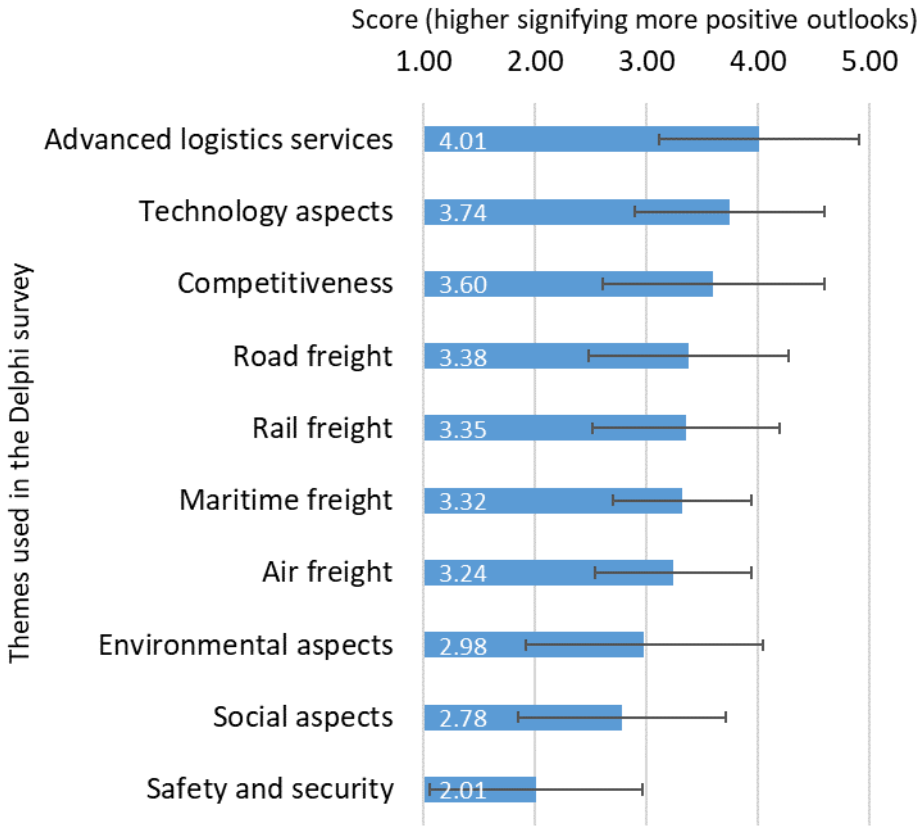

Figure 27 Weighted results of the Delphi study by theme in descending order

Figure 29 shows that seven of the ten categories rank above the middle, ergo have a score higher than three. Only the environmental aspects, social aspects and safety and security themes rank below the midline. Safety and security ranks especially low, with a difference of 0.77 from the score of the second lowest theme. The standard deviations are rather high in all ten themes, which tells us that there was a lot of variation in the opinions of the expert panel, meaning that the outlooks for T&L in the BSR^{-1} were not easy to forecast.

There was also a lot of variation in the question scores within the ten themes, and some questions from very high-ranking themes gained very low results on an individual level. For example, question 5 regarding taxes and other official charges scored only 2.27, even though the competitiveness theme had an average score of 3.6. Likewise, the score for question 37 deviated from the average score for the theme, but had a more positive value (4.39) than the entire technology aspects theme (3.74). The individual questions with the highest and lowest scores are illustrated in Table 11.

Table 7 Key findings of the 2019 Delphi study

Key findings: Four of the highest and lowest average scores in the Delphi survey.			
	Question number	**Score**	**Expected change by the year 2030 in the Baltic Sea Region**
Highest average values	33	4.47	The demand for parcel deliveries will increase.
	37	4.39	The use of tracking and tracing technologies will increase.
	3	4.32	The importance of T&L for the competitiveness of the region will increase.
	41	4.17	Demand for environmentally sustainable services will increase.
Lowest average values	52	1.72*	Cyberthreats will become more prevevalent.
	43	1.79	Cost of complying with environmental regulation will increase.
	49	1.93*	Cost of complying with regulation on data privacy and protection will increase.
	48	1.97*	Cost of complying with safety and security regulation will increase.
*The question's value is reversed to make all the scores comparable (more positive value signifies more positive outlooks)			

As seen in Table 11, the BSR^{-1} is anticipated to face the following changes: the demand for parcel deliveries will increase, tracking and tracing technologies will become more widely adopted, the importance of T&L for the competitiveness of the BSR will continue to rise, and environmentally friendly transportation and related services will face growing demand. From the lower scale of the score spectrum we gain the following expectations: The prevalence of cyberthreats is expected to increase, and the costs of complying with the increasing of environmental and data privacy and protection regulation, as well as safety and security regulation, are all anticipated to increase.

There were minor differences in the scores of this Delphi survey and the preceding one. The differences in the highest and lowest scoring questions are presented in Table 12.

Table 8 Key differences in the results of the 2013 & 2019 Delphi surveys.

Key findings: Four questions with the highest and lowest average values in the 2019 Delphi survey looking into year 2030 compared to the results of the same questions in the 2013 Delphi survey looking into year 2025. (Only questions included in both survey questionnaires are presented.)					
	Question number in the 2019 survey	**Score**		**Difference**	**Expected change by the year 2030 in the Baltic Sea Region**
		By 2025	**By 2030**		
Highest average values	37	4.65	4.39	-0.26	The use of tracking and tracing technologies will increase.
	41	4.36	4.17	-0.19	Demand for environmentally sustainable services will increase.
	3	4.35	4.32	-0.03	The importance of T&L for the competitiveness of the region will increase.
	10	4.31	4.08	-0.23	Fuel/energy efficiency will increase, especially in road freight.
Lowest average values	11	3.22	2.44	-0.78	Border crossing control of road freight between EU and non-EU countries will become more difficult.
	45	2.61	2.18	-0.43	Availability of skilled labor will decrease.
	5	1.75*	2.27	0.52	Taxes and other official charges will increase.
	43	1.60*	1.79	0.19	Cost of complying with environmental regulation will increase.
*The value is reversed to have the values of 2013 and 2019 surveys portray similar results.					

Table 12 includes only questions that were present in both Delphi surveys. The differences are mostly small, but several break the threshold of 0.5 points. The single biggest difference in the entire study was in border controls between EU and non-EU countries. The lack of skilled labour is now anticipated to be even worse than predicted in the preceding Delphi study, with the score being 0.43 points lower. Taxes and other official charges are still expected to rise, but the score is 0.52 higher than previously, predicting slightly lighter increases.

7.2 Policy recommendations

According to Danielson et al. (2018), the BSR^{-1} has grown to be a model region when it comes to international cooperation within the EU. Commitment in maintaining and reinforcing this achieved unity is required to secure the future growth of the region. The national and regional deciding bodies have an important role in how the future of the BSR^{-1} is going to play out. The

following recommendations are derived from the survey results and will be presented to policymakers:

- Recognition of the increased importance of T&L for competitiveness.
- Focus on the environmental aspects and preparation for upcoming changes.
- Preparation for upcoming tax and regulatory changes.
- Preparation for upcoming technological changes.
- Preparation for possible lack of skilled labour.
- Preparation for the increasing prevalence of cyberthreats.
- Acknowledgment of deteriorating trade relations between Russia and other BSR^{-1} countries.

The survey results anticipate that the role of T&L for regional competitiveness will increase by 2030. Lindholm (2012) argues that understanding of the relevant aspects of T&L among decisionmakers is often lacking or the topic is given too little attention, which leads to lost potential and inefficient operations. This should be attended by highlighting the importance of T&L, putting more effort into and researching T&L related decisions more thoroughly, and including T&L departments or third-party operators more in the decision making process.

According to the survey, and on par with the report from the European Commission (2017a), increasing environmental regulation will create restrictions for supply chains by limiting the emissions caused by vehicles/vessels and setting rules for tracking and tracing through the supply chains. The used vehicles, routes and even strategies need to be reconsidered and perhaps reworked.

Increasing taxing and regulation due to political shifts and the aforementioned environmental regulation will increase the costs of T&L operations. This could hamper the effectiveness of the industry, although in the long run there is a chance that the confined operational possibilities might have a positive effect on competitiveness through increased innovation, as organisations are forced to find new ways to be profitable (Makkonen & Repka, 2016). Nevertheless, the upcoming changes should be considered while calculating budgets, evaluating cost efficiency and designing future supply chains in general. The cost-effectiveness of logistic companies might decrease, and some tax or regulation changes need to be considered to keep the operations of such companies profitable.

According to PWC (2019) and DHL (2017), technological advancements will have an impact on the T&L sector in the future. The new innovations that have shown sufficient positive results need to be implemented in the existing supply chains to keep up with the competition. Decision makers need to be up to date with the latest developments and consider how these will alter T&L in the future. The regulations need to be kept up to date to allow the companies to adopt important new technologies.

Kersten et al. (2014) discussed 16 megatrends, of which one is the so-called talent shortfall, thought to be caused by demographic changes. It is anticipated that the logistics sector will face a lack of skilled labour in the coming years, and especially young people find the T&L industry quite unattractive nowadays. The survey results gave similar results when it comes to the blue-

collar workforce. Incentives to encourage people to pursue blue-collar logistics education are needed in the BSR^{-1}.

PWC (2011) argues that the cyberattacks will become more common in the future. The survey results anticipated an increasing prevalence of cyberthreats as well. Cybersecurity needs to be kept up to date in all parts of the supply chain. A thorough assessment of a new innovation is required, especially when it comes to technologies such as the IoT, which creates easy openings for cybercriminals.

According to Makarychev (2012), Russia and the EU have differing views on how the politics regarding the BSR^{-1} should be organised. The survey results anticipate that the differences could escalate, and cooperation between Russia and other BSR^{-1} countries is expected to deteriorate further. Decision makers should prepare for increasing costs and difficulties at border crossings. Vital functions in the supply chain should not rely too heavily on cooperation with Russian organisations.

7.3 Possible subsequent research

The purpose was to study the T&L industry, and only aspects deemed important to this topic were included in this research. As the research in this thesis is narrowed down to a specific sector within the BSR^{-1}, it only scratches the surface of what the future could bring to the region by the year 2030. This thesis could be used as a part, amongst other futures research regarding the BSR^{-1}, for more comprehensive futures analysis of the region. Research at national level conducted on each of the region's countries would already provide more stable and reliable results.

A cross-impact analysis of the intertwining effects of the results of the Delphi survey would be a natural continuum for the futures scanning and Delphi study conducted in this thesis, and would form a basis for further research leading to BSR^{-1} related scenarios. Additionally, creating a similar study after some years in the same manner as this one would provide a linear dataset on the future expectations of the T&L sector in the BSR^{-1}. Combined with the preceding research by Ojala et al. (2013), these studies could lay the foundation for a solid longitudinal study.

In terms of the Delphi method and futures studies in general, further research is required to understand the provided benefits. The importance of futures studies lies not in their absolute accuracy, but in the trade-off of policymakers making their decisions with or without a guiding futures study at their disposal.

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APPENDIX 1 – STATISTICAL ANALYSIS

In the Delphi survey conducted in this research a higher score signifies a more positive outlook, except in theme 10 (Safety & Security), where the opposite was true. The scores for theme 10 were therefore reversed to make them compatible with the others. With the data thus all aligned the same way, the following null hypotheses can be tested:

1. The outlooks are similar in the western and eastern BSR^{-1} countries.
2. The responses of those who participated in both Delphi surveys (2013 and 2019) do not differ from those who only participated in the latter (2019).

For the first hypothesis we tested whether the responses of participants from Estonia, Latvia, Lithuania, Poland or Russia differed from those from Denmark, Finland, Germany, Norway or Sweden. The purpose of the second hypothesis was to test whether the responses from participants who took part in both Delphi surveys (the one by Ojala et al. (2013) and the one conducted for this thesis in 2019) differed from the those of participants who only took part in the latter (2019).

Hypothesis 1

The choice of statistical methods depends on the data under analysis. The independent sample Student's t-test was chosen to compare differences between the groups, as the following assumptions to conduct it were met in both tested null hypotheses:

- Independent observations. The respondent is either from west or east and responded either in *only one* or *both* of the surveys.
- Homogeneity. In most themes the standard deviations and group sizes do not differ significantly. Homogeneity is tested with Levene's test in Tables 8 and 10.
- Normality. Sample sizes are large enough to assume normality, as both sample groups in both hypotheses exceed 30 in each theme.

However, according to Ghasemi and Zahediasl (2012), a sufficient size to assume normality could even be as high as 40. Hence, despite the large sample sizes, the data regarding the first hypothesis for all 10 themes was tested for normality with the one-sample Kolmogorov Smirnov test (with the Lilliefors correction). Only themes 2 (road freight) and 5 (maritime freight) were distributed normally. The results of the Kolmogorov Smirnov test for normality, along with some descriptive data, are illustrated in Table 7. (Steinskog et al. 2007.)

Table 9 Descriptive data for testing the first null-hypothesis and Kolmogorov Smirnov test for normality

Theme	Group	Descriptive data				One-Sample Kolmogorov Smirnov Test	
		N	Mean	Standard Deviation	Standard Error Mean	Significance	Hypothesis: Data is Normally Distributed
Competitiveness	West	52	3.61	0.54	0.07	0.001	Rejected
	East	38	3.74	0.51	0.08		
Road	West	51	3.53	0.35	0.05	0.060	**Retained**
	East	38	3.61	0.39	0.06		
Rail	West	51	3.25	0.58	0.08	0.013	Rejected
	East	38	3.74	0.52	0.08		
Air	West	51	3.51	0.51	0.07	0.000	Rejected
	East	37	3.47	0.65	0.11		
Maritime	West	50	3.55	0.33	0.05	0.200	**Retained**
	East	38	3.73	0.38	0.06		
Advanced	West	51	4.27	0.33	0.05	0.000	Rejected
	East	38	4.18	0.45	0.07		
Technological	West	51	3.97	0.35	0.05	0.002	Rejected
	East	38	4.03	0.38	0.06		
Environmental	West	51	3.99	0.67	0.09	0.001	Rejected
	East	38	4.10	0.71	0.12		
Social	West	49	2.97	0.64	0.09	0.002	Rejected
	East	38	3.09	0.69	0.11		
Safety & Security	West	48	2.04	0.46	0.07	0.004	Rejected
	East	38	2.11	0.43	0.07		

As illustrated in Table 7, only theme 2 (road freight T&L) along with theme 5 (Maritime freight T&L) were normally distributed at the 95% confidence level. With a significance level of 0.01 < 0.05, theme 3 (rail freight T&L) would be normally distributed as well. Given the size of the samples under analysis (>30), the t-test could have been applied anyway despite the result showing non-normal data, as the sampling distribution is assumed to be normal in large sample sizes (Kwak & Kim, 2005). However, as discussed above, the sample sizes could still be considered to be rather small, hence the non-parametric Mann-Whitney U test was conducted as well. The test results for hypothesis 1 are illustrated in Table 8.

Table 10 Testing null hypothesis 1: Outlooks are similar in the western and eastern BSR^{-1} countries

Theme	Tests on null hypothesis 1: Outlooks are similar in the western and the eastern BSR countries.										
	t-test for Equality of Means										Mann-Whitney U Test
	Levene's Test for Equality of Variances		Significance	t	df	Significance (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference		Significance
	Equality of Variances assumed	F							Lower	Upper	
Competitiveness	X	0.30	0.583	-1.21	88.00	0.230	-0.14	0.11	-0.36	0.09	0.189
				-1.22	82.51	0.226	-0.14	0.11	-0.36	0.09	
Road	X	0.62	0.433	-1.00	87.00	0.320	-0.08	0.08	-0.23	0.08	0.239
				-0.98	74.23	0.329	-0.08	0.08	-0.24	0.08	
Rail	X	0.96	0.329	-4.11	87.00	**0.000**	-0.49	0.12	-0.72	-0.25	**0.000**
				-4.18	84.20	**0.000**	-0.49	0.12	-0.72	-0.26	
Air	X	6.14	0.015	0.27	86.00	0.788	0.03	0.12	-0.21	0.28	0.904
				0.26	66.02	0.796	0.03	0.13	-0.22	0.29	
Maritime	X	1.28	0.260	-2.28	86.00	**0.025**	-0.17	0.08	-0.33	-0.02	0.066
				-2.23	72.98	**0.029**	-0.17	0.08	-0.33	-0.02	
Advanced	X	4.09	0.046	1.05	87.00	0.295	0.09	0.08	-0.08	0.25	0.465
				1.00	63.76	0.319	0.09	0.09	-0.09	0.26	
Technological	X	0.54	0.465	-0.77	87.00	0.445	-0.06	0.08	-0.21	0.09	0.517
				-0.76	75.90	0.451	-0.06	0.08	-0.22	0.10	
Environmental	X	1.10	0.298	-0.75	87.00	0.454	-0.11	0.15	-0.40	0.18	0.366
				-0.74	76.69	0.459	-0.11	0.15	-0.41	0.19	
Social	X	0.14	0.712	-0.83	85.00	0.409	-0.12	0.14	-0.40	0.17	0.523
				-0.82	76.98	0.413	-0.12	0.14	-0.41	0.17	
Safety & Security	X	0.21	0.650	-0.66	84.00	0.514	-0.06	0.10	-0.26	0.13	0.310
				-0.66	82.09	0.510	-0.06	0.10	-0.25	0.13	

In Table 8, in Levene's test for equality of variances, the background is grey and marked X if equality was assumed. The results of the t-test and Mann-Whitney U test finally reveal whether there was any difference between the two groups. A grey background indicates that the null hypothesis was rejected and that there was a statistically significant difference.

As seen in Table 8, the anticipated change in themes 3 (Rail) and 5 (Maritime) seem to differ between the western and eastern BSR^{-1} countries. The Mann-Whitney U test fortifies the result of the t-test with a similar conclusion for theme 3, and theme 5 comes close to the 0.05 significance level. The results of the analysis do not mean that one country is going to be better than the other in 2030, but merely that eastern countries are somewhat more optimistic about the future than western ones. However, the differences are rather minor.

Hypothesis 2

The second null hypothesis was that the responses of those who participated in both Delphi surveys (2013 and 2019) do not differ from those who only participated in the latter (2019). Table 9 below exhibits some basic values regarding the statistical tests, along with the results of the normality test.

Table 11 Descriptive data for testing the second null-hypothesis

Theme	Participation in the Delphi studies	Descriptive data				One-Sample Kolmogorov Smirnov Test	
		N	Mean	Standard Deviation	Standard Error Mean	Significance	Hypothesis: Data is Normally Distributed
Competitiveness	OnlySecond	56	3.58	0.51	0.07	0.000	Rejected
	Both	40	3.80	0.50	0.08		
Road	OnlySecond	55	3.50	0.37	0.05	0.104	**Retained**
	Both	40	3.65	0.34	0.05		
Rail	OnlySecond	54	3.47	0.64	0.09	0.023	Rejected
	Both	40	3.42	0.56	0.09		
Air	OnlySecond	55	3.44	0.64	0.09	0.000	Rejected
	Both	39	3.53	0.49	0.08		
Maritime	OnlySecond	55	3.61	0.42	0.06	0.200	**Retained**
	Both	39	3.65	0.29	0.05		
Advanced	OnlySecond	56	4.20	0.39	0.05	0.000	Rejected
	Both	39	4.27	0.39	0.06		
Technological	OnlySecond	56	3.93	0.37	0.05	0.002	Rejected
	Both	39	4.08	0.31	0.05		
Environmental	OnlySecond	56	3.22	0.74	0.10	0.001	Rejected
	Both	39	3.50	0.70	0.11		
Social	OnlySecond	54	2.97	0.73	0.10	0.002	Rejected
	Both	39	3.06	0.56	0.09		
Safety & Security	OnlySecond	55	2.08	0.61	0.08	0.000	Rejected
	Both	40	1.93	0.54	0.08		

As seen in Table 9, the normal distribution in the data is almost identical to the one tested for hypothesis 1. The number of respondents is slightly different for some of the themes, but the same conclusion is still achieved: themes 2 and 5 are distributed normally and the rest are not. Additionally, it can be noted that the standard deviation is slightly lower for those who took part in both surveys, and although not much can be derived from the minor differences, perhaps there is some benefit to increased confidence and experience when using the same panel of experts again in a follow-up survey. The results of the statistical analysis conducted to test hypothesis 2 are illustrated in Table 10.

Table 12 Testing null hypothesis 2: The responses of those who participated in both Delphi surveys (2013 and 2019) regarding future outlooks for transport and logistics in the BSR^{-1} do not differ from those who only participated in the latter (2019).

Tests on null hypothesis 2: There is no difference in the responses between participants who took part in both surveys and those who only took part in the latter										
t-test for Equality of Means										**Mann-Whitney U Test**
Levene's Test for Equality of Variances		**Significance**	**t**	**df**	**Significance (2-tailed)**	**Mean Difference**	**Std. Error Difference**	**95% Confidence Interval of the Difference**		**Significance**
Equality of Variances assumed	**F**							**Lower**	**Upper**	
X	0.05	0.826	-2.06	94.00	**0.042**	-0.22	0.11	-0.43	-0.01	**0.044**
			-2.07	85.21	**0.042**	-0.22	0.11	-0.43	-0.01	
X	0.63	0.431	-1.99	93.00	**0.049**	-0.15	0.07	-0.30	0.00	**0.037**
			-2.03	88.76	**0.046**	-0.15	0.07	-0.29	0.00	
X	1.26	0.265	0.37	92.00	0.709	0.05	0.13	-0.20	0.30	0.753
			0.38	89.23	0.704	0.05	0.12	-0.20	0.29	
X	2.84	0.095	-0.78	92.00	0.438	-0.09	0.12	-0.34	0.15	0.717
			-0.81	91.29	0.418	-0.09	0.12	-0.33	0.14	
X	4.05	0.047	-0.55	92.00	0.584	-0.04	0.08	-0.20	0.11	0.300
			-0.59	91.86	0.560	-0.04	0.07	-0.19	0.10	
X	0.00	0.983	-0.78	93.00	0.438	-0.06	0.08	-0.22	0.10	0.421
			-0.78	81.80	0.439	-0.06	0.08	-0.22	0.10	
X	0.97	0.327	-2.17	93.00	**0.033**	-0.16	0.07	-0.30	-0.01	**0.040**
			-2.24	89.44	**0.028**	-0.16	0.07	-0.30	-0.02	
X	1.34	0.251	-1.85	93.00	0.068	-0.28	0.15	-0.58	0.02	**0.042**
			-1.87	84.60	0.066	-0.28	0.15	-0.58	0.02	
X	3.24	0.075	-0.66	91.00	0.513	-0.09	0.14	-0.37	0.19	0.412
			-0.69	90.62	0.495	-0.09	0.13	-0.36	0.17	
X	0.30	0.583	1.25	93.00	0.213	0.15	0.12	-0.09	0.39	0.112
			1.28	89.77	0.204	0.15	0.12	-0.08	0.39	

The differences between the tested groups are illustrated in the same manner as in the first null hypothesis. In Table 10, in the Levene's test for equality of variances, the background is grey with an X if equality was assumed. The results of the t-test and Mann-Whitney U test again reveal whether there was a difference between the two groups. A grey background means that the null hypothesis was rejected, signifying a statistically significant difference.

As seen in Table 10, Student's t test found difference in themes 1 (road freight), 2 (rail freight) and 7 (technological aspects), while the Mann-Whitney U tests found differences in all the aforementioned themes and additionally in theme 8 (environmental aspects). These findings are achieved with a confidence level of 95%. It seems that although minor, there seem to be some difference in the results obtained with an expert panel that had taken part in a preceding survey on the same topic, vs using a panel that was participating for the first time.

APPENDIX 2 – SURVEY QUESTIONNAIRE IMPORTED FROM QUALTRICS

Informed Consent

Welcome to the Baltic Sea Region Logistics 2030 survey!

As one of the approximately 100 experts, I cordially invite You to take part in the second and final phase of our survey on the state of logistics in the Baltic Sea Region by 2030! In this phase, You have the opportunity to change Your answers from the first round.

This confidential survey is part of a EU funded seaport safety & security project HAZARD. Its 52 statements are based on a similar study we made in 2013 (Ojala et al. 2013). The aggregated results are published in a policy report in spring 2019. The names and answers of individual participants will not be revealed in the results in any way.

You should have received the results of the first round by the time You are taking this survey. The results show Your answers statement by statement against the mean and standard deviation of the whole respondent population. For convenience during the survey, if You have two monitors at Your disposal, we recommend opening the results in one display and the survey in the other.

Your responses from the previous round are saved in the survey, and you can now alter them as you wish. You don't have to do anything to the responses You wish to leave unchanged. However, the answers submitted now, will be final.

If You have any questions, or technical difficulties, please contact Mr. Eeli Friman at: eakfri@utu.fi, or me at lauri.ojala@utu.fi. Please, respond to the survey by **Monday, February 18, 2019**, using Your laptop, tabletop or mobile device.

Professor Lauri Ojala, HAZARD Project Director, University of Turku, Finland
Researcher Mr. Eeli Friman, University of Turku, Finland

I consent, begin the study
I do not wish to participate

Demographics

Country of residence (select)

Please indicate which one of the following best describes your current position:

- Academic
- Corporate
- Government
- Industry Association
- Other

BSR

In this survey, the Baltic Sea Region (BSR) comprises the following:

Belarus, Denmark, Estonia, Finland, Northern Germany, Latvia, Lithuania, Norway, Poland, Sweden and North-West Russia

Source: Interreg Baltic Sea Region (2018) Area. <https://www.interreg-baltic.eu/about-the-programme/area.html>, retrieved 25.10.2018

Start

Start of the survey.

The survey contains 52 statements, with six (6) answer options in each. The statements are grouped in ten (10) themes comprising three (3) to nine (9) statements each.

At the beginning you will be asked to evaluate the level of your expertise on the themes.

We thank you in advance for taking the time to answer this survey.

Expertise

Please, evaluate your level of expertise on the following themes in the Baltic Sea Region (BSR) context:

	Very low	Low	Intermediate	High	Very high
Competitiveness of the transport and logistics sector	○	○	○	○	○
Road freight transport and logistics	○	○	○	○	○
Rail freight transport and logistics	○	○	○	○	○
Air freight transport and logistics	○	○	○	○	○
Maritime freight transport and logistics	○	○	○	○	○
Advanced logistic services	○	○	○	○	○
Transport and logistics related technology	○	○	○	○	○
Environmental aspects related to transport and logistics	○	○	○	○	○
Social aspects related to transport and logistics	○	○	○	○	○
Supply chain safety and security	○	○	○	○	○

Theme I

THEME I: COMPETITIVENESS OF THE TRANSPORT AND LOGISTICS SECTOR

This theme comprises six (6) statements.

Competitiveness

(1/52) By 2030, the VOLUME OF INDUSTRIAL PRODUCTION in the BSR will …

1: significantly decrease
2: somewhat decrease
3: not change
4: somewhat increase
5: significantly increase
6: no opinion

(2) By 2030, the share of the logistics and transport sector of the combined GROSS DOMESTIC PRODUCT in the BSR will ...

1: significantly decrease
2: somewhat decrease
3: not change
4: somewhat increase
5: significantly increase
6: no opinion

(3) By 2030, the importance of the logistics and transport sector for the COMPETITIVENESS of the BSR will ...

1: significantly decrease
2: somewhat decrease
3: not change
4: somewhat increase
5: significantly increase
6: no opinion

(4) By 2030, the importance of the logistics and transport sector in attracting FOREIGN DIRECT INVESTMENT into the BSR will ...

1: significantly decrease
2: somewhat decrease
3: not change
4: somewhat increase
5: significantly increase
6: no opinion

(5) By 2030, TAXES, USER FEES AND OTHER OFFICIAL CHARGES (e.g. on vehicles, fuel, infrastructure usage) paid by the logistics and transport sector in the BSR will ...

1: significantly increase
2: somewhat increase
3: not change
4: somewhat decrease
5: significantly decrease
6: no opinion

(6) By 2030, the SHARE OF PRIVATELY OWNED TRANSPORT INFRASTRUCTURE in the BSR will...

1: significantly decrease
2: somewhat decrease
3: not change
4: somewhat increase
5: significantly increase
6: no opinion

Theme II

THEME II: ROAD FREIGHT TRANSPORT AND LOGISTICS

This theme comprises nine (9) statements.

Road

(7) By 2030, the operational efficiency of ROAD FREIGHT TRANSPORT in the BSR (due to e.g. route planning, empty running, load factor) will…

1: significantly decrease
2: somewhat decrease
3: not change
4: somewhat increase
5: significantly increase
6: no opinion

(8) By 2030, ROAD TRANSPORT INFRASTRUCTURE in the BSR will have …

1: significant undercapacity
2: some undercapacity
3: neither under-/overcapacity
4: some overcapacity
5: significant overcapacity
6: no opinion

(9) By 2030, the technical condition of ROAD TRANSPORT INFRASTRUCTURE in the BSR will ..

1: significantly deteriorate
2: somewhat deteriorate
3: not change
4: somewhat improve
5: significantly improve
6: no opinion

(10) By 2030, fuel/energy efficiency in ROAD FREIGHT TRANSPORT in the BSR will be significantly improved.

1: definitely not
2: unlikely
3: possibly
4: probably
5: definitely
6: no opinion

(11) By 2030, BORDER CROSSING CONTROL OF CARGO, DOCUMENTS, VEHICLE AND DRIVER in road freight transport between EU and non-EU countries in the BSR will have become …

1: significantly stricter
2: somewhat stricter
3: not change
4: somewhat looser
5: significantly looser
6: no opinion

(12) By 2030, the MAXIMUM ALLOWED WEIGHTS AND MEASUREMENTS in international road freight transport within the BSR will be …

1: significantly smaller
2: somewhat smaller
3: not change
4: somewhat larger
5: significantly larger
6: no opinion

(13) By 2030, the concentration* in INTERNATIONAL ROAD FREIGHT TRANSPORT MARKET in the BSR will… (*The market share of the largest vs. smaller transport providers)

1: significantly decrease
2: somewhat decrease
3: not change
4: somewhat increase
5: significantly increase
6: no opinion

(14) By 2030, the share of intra-EU road freight in the BSR transported by LOW-COST COUNTRY CARRIERS will ...

1: significantly decrease
2: somewhat decrease
3: not change
4: somewhat increase
5: significantly increase
6: no opinion

(15) By 2030, the level of outsourcing by shippers (transport users) of INTERNATIONAL ROAD TRANSPORT within the BSR will …

1: significantly decrease
2: somewhat decrease
3: not change
4: somewhat increase
5: significantly increase
6: no opinion

Theme III

THEME III: RAIL FREIGHT TRANSPORT AND LOGISTICS

This theme comprises five (5) statements.

Rail

(16) By 2030, the share of RAIL of the total INTERNATIONAL FREIGHT TRANSPORT performance (ton-km) in the BSR will …

1: significantly decrease
2: somewhat decrease
3: not change
4: somewhat increase
5: significantly increase
6: no opinion

(17) By 2030, the operational efficiency of RAIL FREIGHT TRANSPORT in the BSR (due to e.g. scheduling, train composition, load factor) will…

1: significantly decrease
2: somewhat decrease
3: not change
4: somewhat increase
5: significantly increase
6: no opinion

(18) By 2030, RAIL TRANSPORT INFRASTRUCTURE in the BSR will have…

1: significant undercapacity
2: some undercapacity
3: neither under-/overcapacity
4: some overcapacity
5: significant overcapacity
6: no opinion

(19) By 2030, the technical condition of RAIL TRANSPORT INFRASTRUCTURE for in the BSR will ...

1: significantly deteriorate
2: somewhat deteriorate
3: not change
4: somewhat improve
5: significantly improve
6: no opinion

(20) By 2030, fuel/energy efficiency in RAIL TRANSPORT in the BSR will be significantly improved.

1: definitely not
2: unlikely
3: possibly
4: probably
5: definitely
6: no opinion

Theme IV

THEME IV: AIR FREIGHT TRANSPORT AND LOGISTICS

This theme comprises three (3) statements.

Air

(21) By 2030, AIRPORT and AIR TRANSPORT INFRASTRUCTURE in the BSR will have …

1: significant undercapacity
2: some undercapacity
3: neither under-/overcapacity
4: some overcapacity
5: significant overcapacity
6: no opinion

(22) By 2030, the technical condition of AIRPORT and AIR TRANSPORT INFRASTRUCTURE in the BSR will …

1: significantly deteriorate
2: somewhat deteriorate
3: not change
4: somewhat improve
5: significantly improve
6: no opinion

(23) By 2030, fuel/energy efficiency in AIR TRANSPORT in the BSR will be significantly improved.

1: definitely not
2: unlikely
3: possibly
4: probably
5: definitely
6: no opinion

Theme V

THEME V: MARITIME FREIGHT TRANSPORT AND LOGISTICS

This theme comprises seven (7) statements.

Maritime

(24) By 2030, CONTAINER TRAFFIC in the BSR will ...

1: significantly decrease
2: somewhat decrease
3: not change
4: somewhat increase
5: significantly increase
6: no opinion

(25) By 2030, MARITIME and PORT INFRASTRUCTURE in the BSR will have …

1: significant undercapacity
2: some undercapacity
3: neither under-/overcapacity
4: some overcapacity
5: significant overcapacity
6: no opinion

(26) By 2030, the technical condition of PORT and MARITIME TRANSPORT INFRASTRUCTURE in the BSR will …

1: significantly deteriorate
2: somewhat deteriorate
3: not change
4: somewhat improve
5: significantly improve
6: no opinion

(27) By 2030, fuel/energy efficiency in MARITIME TRANSPORT in the BSR will be significantly improved.

1: definitely not
2: unlikely
3: possibly
4: probably
5: definitely
6: no opinion

(28) By 2030, the concentration* in LINER AND RO-RO SHIPPING MARKET in the BSR will... (*The market share of the largest vs. smaller transport providers)

1: significantly decrease
2: somewhat decrease
3: not change
4: somewhat increase
5: significantly increase
6: no opinion

(29) By 2030, the NORTHEAST PASSAGE has become a significant maritime route for trade between BSR and Asia.

1: definitely not
2: unlikely
3: possibly
4: probably
5: definitely
6: no opinion

(30) By 2030, RUSSIAN PORTS in the Gulf of Finland will have ...

1: significant undercapacity
2: some undercapacity
3: neither under-/overcapacity
4: some overcapacity
5: significant overcapacity
6: no opinion

Theme VI

THEME VI: ADVANCED LOGISTICS SERVICES

This theme comprises four (4) statements.

Advanced

(31) By 2030, the concentration* in the market FOR PROVISION OF ADVANCED LOGISTICS SERVICES (3PL, 4PL, etc.) in the BSR will… (*The market share of the largest vs. smaller transport providers)

1: significantly decrease
2: somewhat decrease
3: not change
4: somewhat increase
5: significantly increase
6: no opinion

(32) By 2030, the level of outsourcing of MATERIALS MANAGEMENT AND VALUE-ADDED SERVICES (e.g. warehousing, inventory management, product customization) among logistics users operating in the BSR will …

1: significantly decrease
2: somewhat decrease
3: not change
4: somewhat increase
5: significantly increase
6: no opinion

(33) By 2030, the demand for PARCEL DELIVERIES (B2B AND B2C) in the BSR will ….

1: significantly decrease
2: somewhat decrease
3: not change
4: somewhat increase
5: significantly increase
6: no opinion

(34) By 2030, HIGH QUALITY WAREHOUSING CAPACITY in the BSR will …

1: significantly decrease
2: somewhat decrease
3: not change
4: somewhat increase
5: significantly increase
6: no opinion

Theme VII

THEME VII: TRANSPORT AND LOGISTICS RELATED TECHNOLOGY

This theme comprises six (6) statements.

Technology

(35) By 2030, TELECOMMUNICATIONS INFRASTRUCTURE in the BSR will have …

1: significant undercapacity
2: some undercapacity
3: neither under-/overcapacity
4: some overcapacity
5: significant overcapacity
6: no opinion

(36) By 2030, the level of outsourcing of LOGISTICS INFORMATION PROCESSING (e.g. order handling, invoicing, information systems) among logistics users operating in the BSR will …

1: significantly decrease
2: somewhat decrease
3: not change
4: somewhat increase
5: significantly increase
6: no opinion

(37) By 2030, the use of TRACKING AND TRACING TECHNOLOGIES in logistics in the BSR will ...

1: significantly decrease
2: somewhat decrease
3: not change
4: somewhat increase
5: significantly increase
6: no opinion

(38) By 2030, significant NEW TECHNOLOGIES not readily available today will already be IN OPERATIONAL USE in logistics in the BSR.

1: definitely not
2: unlikely
3: possibly
4: probably
5: definitely
6: no opinion

(39) By 2030, the use of AUTONOMOUS VEHICLES/VESSELS in freight transport in the BSR will …

1: significantly decrease
2: somewhat decrease
3: not change
4: somewhat increase
5: significantly increase
6: no opinion

(40) By 2030, over 95 % of all INTERNATIONAL SHIPMENTS in the BSR using a Waybill will be relying on an ELECTRONIC WAYBILL INSTEAD OF PAPER DOCUMENTS.

1: definitely not
2: unlikely
3: possibly
4: probably
5: definitely
6: no opinion

Theme VIII

THEME VIII: ENVIRONMENTAL ASPECTS RELATED TO TRANSPORT AND LOGISTICS

This theme comprises three (3) statements.

Environment

(41) By 2030, the demand for ENVIRONMENTALLY SUSTAINABLE logistics services in the BSR will …

1: significantly decrease
2: somewhat decrease
3: not change
4: somewhat increase
5: significantly increase
6: no opinion

(42) By 2030, the GREENHOUSE GAS EMISSIONS CAUSED BY THE TRANSPORT SECTOR in the BSR have been reduced from the levels of 2008 by…

<0%
10>0%
15>10%
20>15%
≥20%
6: no opinion

(43) By 2030, the costs to comply with ENVIRONMENTAL REGULATION in the transport sector in the BSR will …

1: significantly increase
2: somewhat increase
3: not change
4: somewhat decrease
5: significantly decrease
6: no opinion

Theme IX

THEME IX: SOCIAL ASPECTS RELATED TO TRANSPORT AND LOGISTICS

This theme comprises four (4) statements.

Social

(44) By 2030, LABOUR PRODUCTIVITY OF BLUE COLLAR (operational level) logistics and transport personnel in BSR will …

1: significantly decrease
2: somewhat decrease
3: not change
4: somewhat increase
5: significantly increase
6: no opinion

(45) By 2030, due to DEMOGRAPHIC CHANGES (incl. migration, ageing …) the AVAILABILITY OF SKILLED LABOUR for transport and logistics jobs (all levels) in the BSR will ...

1: significantly decrease
2: somewhat decrease
3: not change
4: somewhat increase
5: significantly increase
6: no opinion

(46) By 2030, the AVAILABILITY OF SKILLED PERSONNEL for WHITE COLLAR transport and logistics jobs (managerial level) in the BSR will …

1: significantly decrease
2: somewhat decrease
3: not change
4: somewhat increase
5: significantly increase
6: no opinion

(47) By 2030, the AVAILABILITY OF SKILLED PERSONNEL for BLUE COLLAR transport and logistics jobs in the BSR will …

1: significantly decrease
2: somewhat decrease
3: not change
4: somewhat increase
5: significantly increase
6: no opinion

Theme X

THEME X: SUPPLY CHAIN SAFETY AND SECURITY

This theme comprises five (5) statements.

Safety and security

(48) By 2030, the costs to comply with SAFETY AND SECURITY REGULATION in the transport sector in the BSR will …

1: significantly decrease
2: somewhat decrease
3: not change
4: somewhat increase
5: significantly increase
6: no opinion

(49) By 2030, the costs to comply with REGULATION ON DATA PRIVACY AND PROTECTION in the transport sector in the BSR will …

1: significantly decrease
2: somewhat decrease
3: not change
4: somewhat increase
5: significantly increase
6: no opinion

(50) By 2030, the PROBABILITY OF EXTERNAL SUPPLY CHAIN DISRUPTIONS due to BSR-based causes (e.g. political, natural, infrastructural, social) will ...

1: significantly decrease
2: somewhat decrease
3: not change
4: somewhat increase
5: significantly increase
6: no opinion

(51) By 2030, the PREVALENCE OF CARGO THEFTS AND VEHICLE-RELATED CRIMES in international road freight transport in the BSR will …

1: significantly decrease
2: somewhat decrease
3: not change
4: somewhat increase
5: significantly increase
6: no opinion

(52) By 2030, the PREVALENCE OF CYBER THREATS in logistics in the BSR will …

1: significantly decrease
2: somewhat decrease
3: not change
4: somewhat increase
5: significantly increase
6: no opinion

Block 5

End of the survey. Click the arrow on the left if you want to go back and change your answers.
Click the arrow on the right to send your final answers.

The HAZARD project has 14 full Partners and a total budget of 4.3 million euros. It is scheduled to run from spring 2016 to spring 2019 and is part-funded by the EU's Baltic Sea Region Interreg programme.

HAZARD aims at mitigating the effects of major accidents and emergencies in major multimodal seaports in the Baltic Sea Region, all handling large volumes of cargo and/or passengers.

Port facilities are often located close to residential areas, thus potentially exposing a large number of people to the consequences of accidents. The HAZARD project deals with these concerns by bringing together rescue services, other authorities, logistics operators and established knowledge partners.

HAZARD enables better preparedness, coordination and communication, more efficient actions to reduce damages and loss of life in emergencies, and handling of post-emergency situations by making a number of improvements.

These include harmonization and implementation of safety and security standards and regulations, communication between key actors, the use of risk analysis methods and adoption of new technologies.

See more at: http://blogit.utu.fi/hazard/

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