SUSTAINABLE CARGO CHECK-IN SOLUTIONS FOR TALLINK SILJA OYJ

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ABSTRACT

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Abstract

The thesis marks the end of my graduation for the degree program of M.Sc. International Business and Entrepreneurship (IBE) at the University of Jyvaskyla, Finland. The main inspiration behind my thesis was the search for a thesis topic with pragmatic implications. It was an earned opportunity because of my participation in a maritime business case competition (IntelligenceHunt2) on behalf of Tallink Silja Oyj (Subsidary of Tallink Grupp AS).

The purpose of this thesis is to explore different methods that can be implemented by Tallink Silja for sustainable and efficient check-in of cargo trucks into their vessels operating in various Baltic cities. The topic explored is a real case scenario with on ground implications. My thesis aims to deliver solutions by exploring different barriers that are product of the natural evolution of human lifestyle and suggest solutions using technological advancements and innovations to overcome said barriers and increase efficiency.

In order to understand this qualitative and multiple case study analysis based thesis more thoroughly.

I took a look at different theoretical themes such as Sustainability in logistics, Rapid urbanisation and its effects, the need for Digitalisation and then move towards further explaining the current check-in methods and finally offer our researched and recommended solutions with giving a brief idea into the challenges that company might face implementing these solutions.

Keywords

Sustainability in logistics, Digitalisation, Urbanisation, Tallink Silja,

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1 INTRODUCTION

1.1 Research Background

The background of this thesis was the inherent need to adapt new technologies for the check-in of cargo trucks into Tallink Silja ships operating mainly in Helsinki and other Baltic cities. This 'need' was a direct effect of rapid urbanization and directives given by different city councils to vacate the existing parking place near to port for the construction of different facilities in the same area.

Tallink Silja line (subsidiary of Tallink Grupp AS) is a leading European ferry operator, offering high quality mini-cruises and passenger transport services as well as ro-ro cargo services in the Baltic Sea region. It is also the largest maritime cargo transportation provider in the Baltic region and transports approximately 365,000 cargo units every year.

This thesis topic takes an in-depth look at cargo check in facilities of tallink silja which are very traditional and orthodox in nature with an exception of few ports. We explore different options the company can adapt to overcome the existing problem and make sure they achieve the results sustainably. The current cargo check in system involves the drivers who fill out a form of all their details (route, registration and ID numbers etc.) which were already updated into their proprietary software of 'SeaFreight', which is also used by the transport companies that are using Tallink Siljas cargo services. After that the check in happens by drivers handing over the ticket at the gates which in some ports is manned and in other ports unmanned or in other sense manned but with some automation technologies due to very little traffic or use of basic automation technology by the manned employee. Once the checked in trucks enter the port they have marked lines which separates them according to their cargo categories and then finally loaded onto ship using the ground co-ordination between stewards and CLO (Chief loading Officer).

This process not only made cargo trucks stop and start at least 5 times before getting loaded into the ship. This overall process of traditional check in called for adaption of intelligent technologies which can be used to achieve environmental sustainability and efficiency. As Tallink Silja line is one of the biggest passenger and cargo cruise company in Baltic seas any initiative to change to better sustainability can have a higher very high impact on the output numbers.

In this qualitative thesis we explore different solutions that can be considered by tallink silja cargo to maximize their efficiencies.

1.2 Aim of the thesis

This research aims at being a value addition to the current traditional business practices being implemented by Tallink Silja line (subsidiary of Tallink Grupp AS) at various Baltic ports by using a descriptive approach and providing a structured qualitative basis on which new strategies can be formed. It will do so by answering the following research question:

"How to achieve sustainable solutions for check-in and loading of cargo into ships due to rapid urbanisation in Baltic cities operated by Tallink Silja"

This research and analysis is performed by means of extensive desk research and qualitative surveys done by me at different operational ports of Tallink Silja. There is also additional help from different stake holders who are involved in maritime industry such as city of Helsinki and other IoT companies providing smart solutions for cargo check in and loading. The exploration of ports on ground gave a great insight into the problem and also led the way into research for different solutions tailor made for this problem.

1.3 Implications for Tallink Silja

The vessel operators in the Baltic sea have a significant interest towards preservation of it. As many of them believe that the many picturesque sceneries with archipelagos and its rich marine life above and below the water level are amongst the most important reasons why many tourists choose to travel by sea in these regions. My recommendations also fall in line with Tallink Group's environmental goals which states that "The Group recognizes environmental protection and management as one of its highest priorities and every effort is made to conserve and protect the environment from marine, atmospheric and other forms of pollution, including office based waste" (Tallink Grupp 2017: 57).

Apart from the ambitious goals the group also achieved many significant milestones such as ISO 14001:2015 Environmental Management System Certificate issued by Lloyd's Register and MARPOL Sewage Pollution Prevention Certificate MARPOL Air Pollution Prevention Certificate etc.

I believe that my research and recommendations may have a positive impact of achieving sustainable goals set by the company. As the company has operations going on at various ports. The solutions here impact the ports on a macro and micro scale

2 LITERATURE REVIEW

2.1 What is sustainability in logistics?

In the 21st century many of customers are becoming more 'conscious' (Prokesch, 2010) towards their daily choices and many investors are taking into account the long term impact the organisations has on community and the environment. The need for organisations to practice sustainable supply chain management has never been in more demand than the present day. Time and again many historical instances prove the exact same point. For example, in 2010 the oil spill by British Petroleum (BP) near the US Gulf Coast had a very big impact on its stock value during that fiscal year (Gross, 2010) and another famous example is the voluntary consumer boycott after public was made aware of the sweatshop production of the sportswear brand 'Nike' (Kenyon et al., 2000).

The examination between sustainability and supply chain has become the most studied subject and an important way to move forward for many companies (Kliendorfer et al, 2005). The worldly concept of 'Logistics' (Golinska and Hajdul, 2012:3) has also become the most important and underlying factor for measuring economic growth of different developing and developed nations. In recent times, the rapid speed of globalisation gave rise to many concerns regarding resource depletion and sustainability in business practices especially in maritime industry. Customers are increasingly concerned with the environmental impact of industry and trade activities, so companies start to make business decisions, including supply chain management, based on the customer outlook towards environmental sustainability and turning it into sources of competitive advantage (Corbett and Klassen, 2006; Björklund et al., 2012).

For many companies, although logistics costs are very substantial and ranking second only to cost of goods sold. In the recent findings of International Monetary Fund (IMF), logistics costs only an average of 12% of the world's gross domestic product (GDP) each year (Ballou, 2004). But, when we take the impact of logistics on the environment, it is quite significant. According to the Council of Supply Chain Management Professionals, logistics can produce up to 75 percent of a company's carbon footprint (The Council of Supply Chain Management Professionals, 2008).

To get a deeper understanding of how to achieve sustainable transport methods, I examine different factors involved, namely barriers, regulations and new technologies involved in developing sustainable transport.

2.1.1 Barriers of developing Sustainable transport

To understand the concept of sustainability in transport, I went ahead and analysed what are the main barriers that many organisation or governments (especially EU) face. In my research of many articles I found the barriers given by Golinska and Hajdul (2012) gave the most pragmatic representation of said barriers.

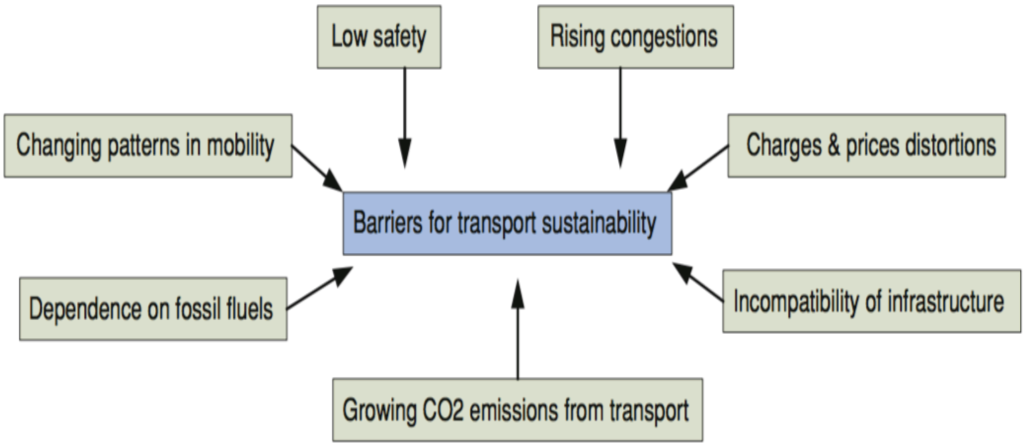


Fig. 1 Barriers for transport sustainability

The many barriers mentioned in the above figure can have a macro or major impact and micro or minor impact on the overall concept. But nonetheless it needs to studied very closely. It must also be noted that many barriers reflected here are majorly from EU perspective as Tallink Siljas operations are only focussed in EU.

The starting point of the barriers is the rising congestion, In EU or many continents. Road transport is considered the major player in transport of logistics and freight contributing to 76.9% of goods transported and railways come in second at 17.6% in the EU. (ec.europa.eu/eurostat/data/database). This has created a major problem considering the carbon footprint it creates compared to any other modes of transport. The lack of use of intermodal transport and intelligent mobility and smart transport management systems seems to be the major contribution towards rising congestion. This takes us to the next barrier associated with the above one ‘Incompatibility in infrastructure’, Golinska and Hajdul (2012) point out that many countries in Europe that designed their infrastructure to only meet their national infrastructure demands as opposed to considering the big picture. This was seen as one of the major bottleneck limitation when trying to integrate European economy through EU.

Other factors such as low safety, dependence on fossil fuels growing CO2 emissions as pointed out in the picture is seen as some consequential barriers to developing sustainability in transport. Especially considering drastic rise in this sector from 20th century. All though many regulations are developed to combat these problems. This still not enough to achieve total sustainability in transport.

2.1.2 European Regulations

The future of any country or an economic union largely relies making sure that the mobility and logistics are as well connected and resulting in smoother flow of logistics. The overall transport activity is set to increase at a very high pace and with that many countries face a not only direct costs such as infrastructure creation and smart mobility but also certain Indirect costs such as noise related pollution, accident management and air related pollution. (Impact Assessment, 2010).

The transport policy in EU came out with a EU 2050 strategy whose main aim is a "Resource Efficient Europe". This mainly aims at introducing cleaner energy alternatives with better utilisation of infrastructure to finally achieve a decarbonised transport system (Haasz et al., 2018). To achieve this objective EU in 2011 came up with a strategy driven transport policy called the 'White papers', which proposed different goals that need to be achieved in transport sector within the cities, between cities and long haul logistics.

The White papers had one long term goal in mind which is alongside with creating smoother logistics flow and reducing 60% of the greenhouse gas emissions by 2050 compared to the level of emissions from 1990 (White Papers, 2011: 9-10). To achieve this ambitious dream, they made following plans. Firstly, they want to start of halving the conventionally fuelled cars by 2030 and eradicating them totally at least inside the city traffic completely. It also states about achieving sustainable fuel consumption which are low carbon in aviation sector by 2030 and also proposed to drastically reduce the use of bunker fuels in maritime industry by 40% by 2050. I would also take a deeper look into these figures and explore more as it is related to the thesis topic.

Apart from the above mentioned changes in fuel consumption and actual emissions output. The papers also concentrated on creating a core network which combines all aviation, rail and maritime sector to create seamless transport of medium and long haul cargo. The creation of an efficient multimodal intercity travel with consolidation of higher volumes of cargo can be described as the best way to achieve a decarbonised transport system (Future of Transport, 2009). Achieving this would significantly increase the economic attractiveness and ease of doing business.

The goals and values of White papers are very ambitious to say the least. The higher emphasis on public transport and faster rate of adoption of renewable and carbon free technologies has become the epicentre of change towards the goal of sustainability.

2.1.3 New technologies

As the world population and its consumption is increasing, so is the demand for energy usage. As the energy resources become scarce day by day, the focus on technologies that use less resources and have no emissions is very high. As each transport sector had their own leaps of innovations in technology. This also helped in achieving economic growth and ultimately reducing the pressure on scarce natural resources. (Gautam et al., 2017)

The adaption of new technologies towards sustainability has become very crucial after International Maritime Organisation (IMO) proposed stricter norms under Annexure VI, which proposed to reduce the emissions of various substances from ships such as sulphur dioxide, Nitrogen oxides, Carbon oxides and other harmful greenhouse gases by 2020 (IMO, 2008). This legislation made many maritime operators explore and understand different solutions towards achieving this goal. Some of them adopted traditional methods such as installing sulphur scrubbers and shifting the fuel to forms of marine marine gas oil (MGO) which emit very little sulphur dioxide and require only cosmetic changes to current built of the ships. Whereas other companies opted to go for alternative fuel types such as adaption of LNG and ethanol to name a few (Møllenbach et al., 2012).

Many Industrial Experts argued that traditional methods are only temporary or have a band aid effect since there is no actual change in emissions as the scrubbers grab the excess sulphur and other volatile emissions and finally dump them in the ocean or other landfills when the scrubbers get cleaned (Jiang et al., 2014). Whereas the goal of sustainable emissions can be achieved through the adaption of other fuel types. The one fuel type that become precedent and the obvious choice of many companies operating in Baltic sea and Europe is liquefied natural gas (LNG). LNG is not only the cleanest of all the fossil fuels currently used but it also readily complies with the sulphur directive regulations.

Since LNG is a gas form of fuel, there are many challenges that need to be addressed before it becomes widespread. The first challenge associated with this are bunkering facilities that need to be available in order to load them into a truck before finally fuelling it into ship. The bunkering facility is a very expensive setup because of the volumes required and also it being a lesser utilised product as compared to traditional fuels. Many companies offering these facilities are trying to mitigate their risks by entering into long-term sale and purchase agreements (SPAs) with existing maritime companies in those areas (Zhuraleva, 2009).

The use of technology towards achieving sustainability has and will always have a well driven result. Jiang et al (2014) research showed that by the use of newer technologies such as LNG. The ships were able to achieve 90% reduction in sulphur dioxide emissions (Jiang et al, 2014: 23-26).

2.2 Role of Digitalisation

The world we are living in today has witnessed a rapid transformation in the use of technology, information and its ability to change the way a product or service is delivered to the customers by many companies. However, this was always not the case in traditional industries (Bharadwaj et al., 2013). Companies in many sectors saw IT or digitalisation strategy as only a functional strategy that should align the chosen strategy of the company. Which is not the case anymore in present day organisational operations (Henderson and Venkatraman, 1993). The recent developments of IT, information gathering and connectivity technologies can be traced back to a significant evolution from aftermath of dotcom bubble. Where firms regardless of their size started to take advantage of lower price of digital performances (i.e. software and hardware) and paired that up with global connectivity which was a result of internet and telecom protocols improvement. This opened a whole new array of functionalities which were used by the companies to improve their productivity significantly and also provide services with more efficiency and less cost (Bharadwaj et al., 2013).

In todays world of interconnectedness every product or service has an underlying digitalisation mechanism embedded in them and its becoming very hard to vary or separate them from their underlying IT infrastructure. Digitalisation was instrumental in companies to achieving various dynamic capabilities especially during turbulent and unpredictable times and also helped organisations to interact with customers and different stakeholders and form a relationship using various social interaction platforms like social media and social networking (Susarla and Tan, 2012). Digitalisation has also enabled organisations of different sizes with the ability to achieve and utilise cross-border industrial disruption technologies ultimately helping them achieve higher productivity with lower cost and better efficiency (Burgelman and Grove, 2007).

In business prospective the term 'Digital business strategy' signifies the amalgamation or fusion of a firm's business strategy and the IT strategy and getting it into perfect sync or simply put 'an organisational strategy formulated and executed by leveraging digital resources to create differential value' (Bharadwaj et al., 2013: 472). This achievement was possible due to numerous advancements in the price/performance capability of computing, software application, bandwidth and storage. Which ultimately lead to the rise of a future generation digital technologies which delivered the services through cloud computing and lead to the evolution of Internet of Things (IoT).

In the next section, I further explain how digitalisation changed the transport Industry and How its helping governments and organisations to become flexible by enabling to make decisions in real time and adapting.

2.2.1 Digitalisation in Transport Sector

The world is changing towards a new generation of digitalisation where the technology is getting embedded into everything in such a way that their existence is not too obvious and further integrating the product/service and the customer with global connectivity (Davidsson et al., 2016). This led to a phenomenon called 'IoT' (Internet of Things), which delivers results by analysing data in various formats and giving efficient and sustainable solutions in real time. The key to this analysis is very much reliant on using various parameters such as big data, open data, crowdsourcing and sensor technologies (Atzori et al., 2010)

The analysis of digitalisation in transport sector can be applied to both public and private sectors of transport. But a deeper look into how it can change public transport is very much intriguing and not to mention the impact it has towards achieving higher sustainability and conscious social awareness. Davidsson et al's., (2016) analysis pointed out that the "demand-responsive transport and collection of traveller data would have the most significant direct impact on several sustainability aspects "(Ronald et al., 2013). Expanding on the above statement, these sustainability aspects are divided into 3 categories. The first one is Social sustainability, second one being Economic sustainability and third one being Environmental sustainability.

The leap from conventional operations in transport sector to digital one helped transport sector achieve social sustainability in multiple fronts. The increased connectivity and transport links brought by digitisation resulted in many people achieving access to many events and activities which resulted in higher life satisfaction and a belonging of social inclusion. At the same time by increasing accessibility of different modes of transport mostly public transport, the achievement towards social equity is further strengthened. Digitalisation also helped governments to achieve higher personal safety and paved the way to better infrastructure by planning and accessing around transport related services.

For Digitalisation to make sense or implement it, public and private transport sector must also realise the scope of Economic sustainability and the results it would yield the concept achieves by its implementation. The main economic advantage the transport sector stake holders achieve is an efficient implementation of 'resource utilisation' that digitalisation achieves. This can be used mainly for strategic planning, re-planning and also give the stake holders the ability to be agile and flexible during turbulent times. Few examples to explain better resource utilisation would be demand responsive transport, better management of unplanned situations, efficient wear and tear management.

Digitalisation can also have a significant impact on achieving environmental sustainability. This is much needed in today's world as many organisations want to show that they are sustainable organisations making responsible choices for their stake holders. When organisations use digitalisation to integrate different data points there is a high level of optimisation in the utilisation of resources. This can not only increase the efficiency of route planning, travel times and maintenance planning. This would also help in travellers becoming more productive as their travel plans are optimised.

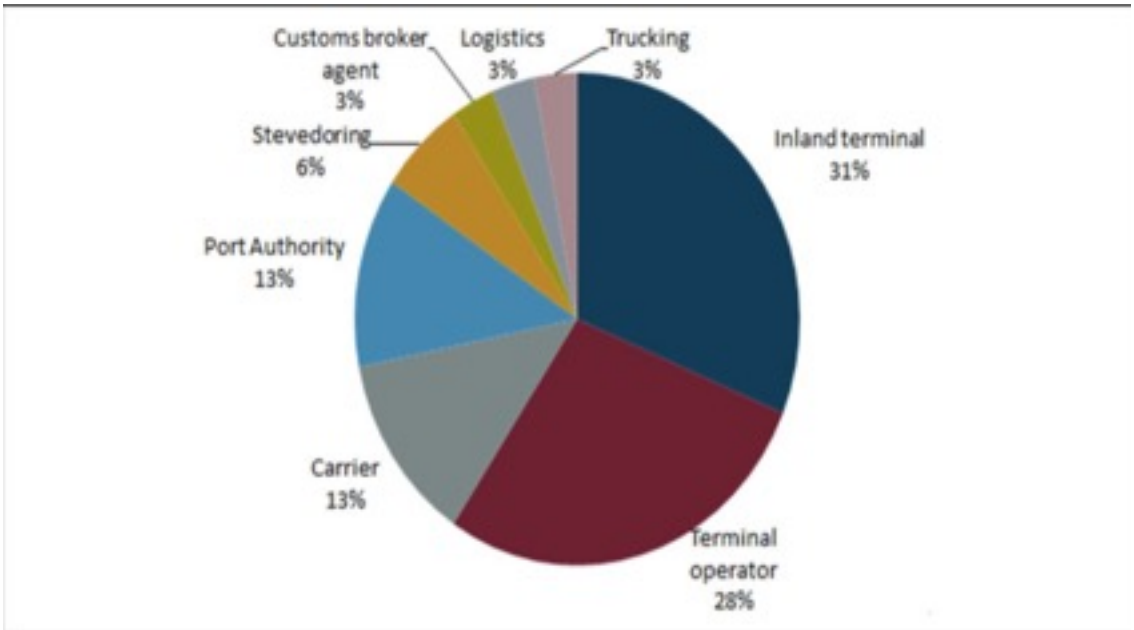
Although digitalisation can be used significantly to achieve various sustainability goals. It also comes with its own set of adaption and implementation issues. The major problem many organisations and governments face while handing big data are the 'security issues' (2016: 11), mainly different leaks initiated or caused by cyber terrorists, hackers and also sometimes by rival firms using cyber security agencies. The other adaption issue faced by many organisations and governments are interoperability and scalability of said digital systems. The problem of interoperability arises when different systems of digitalisation platforms have different communication and operational protocols which would make the integration an issue. The issue of scalability comes when handling the amount of data and how it is stored, as the users and data get bigger the performance and best ways to analyse and utilise data keeps getting more difficult (Davidsson et al., 2016).

2.2.2 Digitalisation in Maritime and Port Sector

After the macro view approach and analysis on how digitalisation created higher efficiency and sustainability in transport sector in general. I shift the focus towards the Maritime and port sector as this is one of the crucial parts of my thesis and research. Unlike other sectors of transport such as roadways and airways digitalisation shift in waterways or maritime industry has been progressing quite slowly. This later shift attributes to many factors such as conventional methods being economically and practically effective or the lack of organisations willingness to change due to change or rise in infrastructure and technical costs. Carlan et al (2017) pointed out in their research that there is a gradual shift towards digitalisation as the existing systems are not able to handle the traffic efficiently since waterways are regarded as the most economical way to transport mass cargo. According to researchers in digitalisation of ports and maritime industry, A report by Mohr et al (2013) showed that the transport sector started to develop ICT solutions since the last 30 years and will also have a continued growth and implementation well after 2020. The evolvement of digitalisation in transport sector saw a slow shift from basic technologies that provided telematics for the transport sector to evolved industry specific contemporary and smart solutions that use Internet of things, cloud computing and big data analysis. The adaption of these digital innovations in the ports helped them achieve cost savings, increased quality and higher opportunity for growth. The three main innovations that play a key role in digitalisation in the port sector are electronic data interchange (EDI) and applications concerning vehicle and cargo monitoring and finally the flow of the cargo. These advancements have progressed largely based on heavy improvements in information and communications technologies (ICT).

The developments and performance results on ICT technologies in contemporary businesses are well known to every industry (Carlan et al., 2017). Digitalisation in the case of ports refers to the ease and facilitation of information and communication exchanges using ICT platforms that facilitate data exchange on different operational parameters and activities. The enhanced information flow or sharing between different stake holder groups at the port is one of the excellent example of how ICT platforms are increasing the productivity at the port.

Digital innovations always appear in multi-disciplinary context and the below figure explains different actors or stake holders involved in a port operations and how the digital Innovation effects them. However, this is a sample size from Carlan et al. (2017: 73) research and cannot be generalised in every port operations situation. The main goal of implementing digital innovation in port sector is to increase and optimize the infrastructure capacity usage. This is mainly achieved by taking different stake holders into account and developing an open collaborative platform which can be used widely.



The rise in use of ICT platforms and digital innovations has seen a drastic reduction in implementation of traditional methodologies. The use of these technologies has also seen rise in competitive advantage with regards to many stake holders. According to Helo & Szekely (2005) on a long term, developers needed to focus on system integration software and process creating standards which calls for standard set of operational protocols than a customised per port protocols. Further on this also points to the implementation and usage challenges pointed out by Ballon & Van Heesvelde (2011) who emphasise the importance of establishing regulatory framework for use of these platforms in the European economic area.

2.3 Rapid Urbanisation

In the last century the global urban population has witnessed a dramatic increase in population shifts. One of the major factors that's influencing these rapid shifts are 'rural-to-urban migrations' (Cox et al., 2018). To extend on the quote, these rapid shifts have always had higher impacts in society as a whole. There are positive impacts such as socio-economic growth with various other benefits. Whereas, on the other hand we also see negative impacts of rapid urbanisation such as overcrowding, increase in pollution and higher stress levels in people. Hartig and Kahn (2016) suggested that this increase in urban population often leads to less space for natural habitat to thrive. Which will also result in people having less interaction and experience with nature and natural world. This cause and effect is dangerous due to the fact that the less experience people have with nature the more likely they are prone to having less understanding and reduced knowledge towards environmental issues.

2.3.1 Macro View Understanding of Urbanisation

To get a better understanding of the impacts of urbanisation, there need to be a consideration from a macro view approach which takes into account 'ecological perspective' (Benerji, 2018). The rapid shift in urban population also leads to large scale repurposing of land usage. The cover of land shifts from its natural habitats such as vegetation, water and soil towards buildings, roads and urban infrastructure which are made of concrete, cement and metallic elements. The major impact of urbanisation is mainly felt in developing countries where there is a larger unplanned shift from 'agri-business-based economy to urban based industrial economy' (Azam and Khan, 2016).

The burden of urbanisation often leads to a phenomenon known as environmental degradation, Where the consequent conversion to urban spatial patterns encroaches upon previously cultivated vegetation, agricultural field and water bodies. Ultimately these resources are not only made scarce, but they end up becoming polluted. This introduction of toxicities in the natural habitat becomes more and more difficult for fauna and human beings to thrive and sustain with each other creating a fragile balance in the environment humans ultimately live in.

2.3.2 Urbanisation Evolution and Impact on Waterscapes

In this thesis I take a closer look into urbanisation and its effects on 'waterscape' which primarily refers to 'landscape in which an expanse of water is a dominant feature'. Although water is considered essential for human habitat the need for living spaces is taking higher precedence and ultimately endangering available waterscapes. In the previous times, fresh water bodies had the capability of not only providing substantial amount of water for daily needs but also had the capacity to replenish itself due to the ecological natural drainage systems.

In the recent year's per capita human consumption of basic necessities have increased drastically. Due to this the natural reservoirs of water have been repurposed, reclaimed and or used as dumping grounds for human waste. The other major fresh water bodies such as rivers, lakes and aquifers have been increasingly contaminated with pollutants due to over exploitation.

In order for urban areas to sustain themselves, both built up area and water bodies need to complement each other. We also need to understand these waterscape dynamics from a landscape point of view and to do that we need to study the shifts and influences of different factors which changed or repurposed these usages over the years.

Blockmans and Voss (1996) studied how waterscapes and maritime culture had an impact on urbanisation. The study was predominantly conducted in North and Baltic sea area but it gives us a wonderful insight into cultural, historic and socio-economic causes of rapid urbanisation and the dynamics of interaction between water bodies and human habitat. In the early days and even still today sea or by ship was seen as the cheapest mode of transport for moving bulk goods or trade. Blockmans and Voss (1996) pointed out in their research that 'The more central a place was in the trading network, the better it was connected to other markets with lower position of hierarchy' (1996: 13). This allowed certain areas of a country with the higher and wider availability of specialised goods and services which other cities or areas more inland could not offer. This also led to a creation of 'material culture' which ultimately ended up influencing a change in culture and economics of these regions (Blockmans and Voss, 1996). This shift in dynamics and availability lead to creation of open economies which means the implied markets have a higher availability of imported products, goods and services which also had relatively higher pattern of consumption.

This was heavily influenced by trade practices adapted from colonialism. Also their strategic positioning with respect to waterways helped them achieve higher trade interactivity increasing its growth from developing to developed areas which competed on par with established urbanised areas. Although one could argue that distribution of these goods can be determined due to general market availability and not because of cultural preconditioning. We should also observe that cultural phenomenon has always had a high influence and form an integral part of commercial connections. The perfect example to explain this stigma is the fashions that originated in southern Europe were easily available in Baltic areas through intermediaries of north shore harbours.

Now that I have established that rapid urbanisation is the cause and factor of availability of specialised goods and services. I have also observed that this availability is hugely influenced by free transfer of goods and services, since sea transport is the major underlying factor that causes the most impact. It will fruitful to understand how international co-operation and marine planning transformed in the recent years and how it impacts the urban environment (Palmowski & Tarkowski, 2018).

2.3.3 Urbanisation in Baltic Coasts

At the start of 20^{th} and 21^{st} century there was a drastic change in terms of attitude and co-operation between countries bordering Baltic sea. This was product and result achieved after the demise of the USSR and an emerging political transformations in central Europe finally resulting in formation of European Union (EU). Later, this relationship also grew stronger due to joint efforts of different Baltic countries signing many international marine conventions and treaties to make sure the trade and overall wellbeing continued. The Baltic Sea in itself is a complex ecosystem, "Where there is a relatively intensive exploitation of marine resources, diverse interests of the stakeholders, and differences in national institutional systems" (Palmowski & Tarkowski, 2018: 100).

In the recent decades, the understanding of complex ecological and social interactions related to urbanisation and planning proved to be quite challenging. To better handle these challenges and to tackle them especially on the Baltic coastline two new concepts emerged namely Marine spatial planning (MSP) and Integrated coastal zone management (ICZM) have gained high popularity. The aforementioned concepts are used to counteract the lag in co-ordination between countries and their coastlines which if the concepts are not in place may ultimately lead to rivalry, miscommunication and possible degradation of the marine environment. These concepts have also helped governing bodies achieve betterment of social and economic life of the countries near the coastlines. Since most of these countries coastline Baltic sea which are also part of EU. The collaborated solutions using MSP and ICZM put forward by European maritime policy have a significant impact on overall developments and future spatial planning. The perfect example for this is the joint efforts lead by HELCOM (Baltic Marine Environment Protection Commission - Hesinki Commission) which is seated in Helsinki, Finland and is the governing body of convention protecting the marine environment around the Baltic Sea area and VASAB (Vision and Strategies around Baltic Sea) that is seated in Riga, Latvia which prepares the policy options for the territorial developments around the Baltic Sea Region providing a forum for exchange of know-how on the spatial planning and development between the Baltic Sea countries. It also recommends transnational policy measures which promote methodological development, cooperation between projects and also other cross-BSR initiatives.

The collaborated as a working group to create "The Action Programme for spatial development VASAB 2010 PLUS". which specifically points out to the development of coastal zones and islands as one of the prime objectives of transnational collaboration in spatial planning and extending spatial planning to include the coastal lands. The impact of this action plan has already started to yield results. In a place called Vistula lagoon which borders Poland-Russia, citizens reported that implemented marine spatial planning helped improve living standards, achieve economic development and helped stimulate mobility of local society.

2.4 Pre-conceptual Understanding of Literature Review

In order to further move onto Methodology and Research understanding. There is a need to understand why certain topics where chosen as literature review and explained further. As the thesis topic suggests I wanted to study and analyse what kind of solutions can be given to the Tallink Grupp, one of the major ship operators in the Baltic sea. This was a thesis that was done as a response to demand or the problem facing the company in the immediate future.

So I started my thesis with the understanding the importance of Sustainability in logistics, because this understands the trends of the consumer behaviour which are shifting towards ethical and mindful purchases that would not only fulfil the demand for the product or service and also who can do it with creating the least amount of damage to the environment. This is what sustainability discusses about, I also further went on to discuss the barriers in developing sustainable transport methods, European regulations that effect the change in sustainability for shipping companies and finally what are the new technologies that can be embedded to achieve sustainability in transport sector.

Furthermore I explained the 'Role of Digitalisation' as I wanted to give a predetermined understanding of how the digital solutions given below in the solutions can have an impact on efficiency and sustainability. For major companies like Tallink Grupp, digitalisation has been a gradual need based change rather than a radical one as many companies believe 'Don't fix it until its broken' philosophy. The further explanation of 'Digitalisation in transport sector' gave different examples of how a sector benefitted from using digital technologies as the workloads increased heavily and to achieve good efficiency this was the need of te hour. After discussing further about 'Digitalisation at Port and Marine technology' to further show the real impact on this specific sector so that the solid examples would become a great preconceptual understanding when moving onto the check-in methods and on ground situations.

Lastly, I looked at the topic of 'Rapid Urbanisation' due to the fact that the need for the solutions or the problem caused was a direct by product of this phenomenon. In every major city the sea ports are located in the centre of the cities and as the cities grow from the port areas, being the first centres of trade and commerce. I also observed scientifically that there is a huge migratory patterns moving from suburban areas to urban areas. So, the demand for city centre properties especially which are close to the water bodies and in the centre vicinity are in extremely high demand. This would in turn push the cities to rezone them into residential, office and mixed use areas catering to that demand and increasing the cities revenue. Hence I felt it was very important to understand this topic deeper. I further went on to explain the impacts of urbanisation on a 'Macro view' and then the 'Evolution and Impact it had on water bodies' and finally how the rapid urbanisation has changed the Baltic coasts as this has direct relevance to the ports operated by Tallink Grupp.

Now that I understood why certain concepts were taken into the literature review and explained further in relevance to the thesis, Let us move on to Methodology and Research Findings.

3 TALLINK GRUPP AS. AND CURRENT CHECK-IN AND LOADING

3.1 Tallink Grupp AS

3.1.1 History and Evolution

To get a better understanding of Tallink Silja Line in respect to its operations and evolution. I studied the company and its history deeply. Tallink Group AS is amalgamation of different business under one name which we will elaborate down below in more detail with all its business operations. In the early days Tallink Line and Silja Line were separate competitors having their base of operations in Estonia and Finland respectively. On 12th June, 2006 the estonian based shipping company bought Silja Line with its 6 cruise ferries for a €470 Million (Dumell 2008:139). This step marked the beginning of the operations of Tallink Silja Line.

The History of **Silja Line** began in the early 1883 when 'The Finnish steamship enterprise' or otherwise also called as Suomen Höyrylaiva Osakeyhtiö (SHO) was established which was the predecessor name of the company that predominantly operated steamships and ferries in Finland. In the year 1918 the same company with the partnership of Rederi AB Svea based out of Sweden launched Turku – Stockholm routes and also later on launching Helsinki – Stockholm route by 1928 with the partnership of Höyrylaiva Oy Bore due the growing demand for the shipping routes.

In the year 1957 the three companies mentioned above formed a separate Finnish and Swedish companies namely 'Siljavarustamo Oy' and 'Siljarederiet AB' to operate the Finnish and Swedish ship routes. In January of 1970 both the above mentioned companies merged to form 'Silja Line'. The company saw a steady rise in its operations with both its passenger segment and cargo segment and in the year 1974 the famous seal logo was introduced. By the year 1989, the company took the delivery of exclusive cargo ship called sea wind which expanded their cargo activities. In the following years of January 1990 and 1991 they also took the delivery of their biggest ferries 'Serenade' and 'Symphony' which are still operational till this date. These ships ended up costing them twice as much as much from their initial estimation assessment. After successful operations of many years in Baltic coast line, Sea Containers Ltd. Acquired 51% of Silja Line making it a foreign owned shipping subsidiary. In 2006 due to financial difficulties of the parent company Sea Containers Ltd sold Silja Line to Tallink Grup AS and on 1st November, the company was finally renamed to 'Tallink Silja Oy ' and continued it operations through Baltic cities (Malmberg 2007: 8-9; Tallink Grupp 2018).

Estonian based **Tallink Grupp AS** on the other hand is established in 1989 January. It was a joint venture of two companies namely Palkkiyhtymä Oy which is Finnish private limited company holding 40% and Estonian based company called Eesti Merelaevandus RAS (ESCO) which held 60 % of the parent company. Their first operations began in 1990 with a vessel called Tallink which operated from Tallinn to Helsinki. Later in 1991 Estonia gained independence allowing for ship operators to do business freely. At the same time the company also witnessed a steady growth of Finnish passengers on board their ships who almost accounted for 60% of the total passengers travelled. (Huopana 2013)

In the year 1993, Palkkiyhtymä Oy sold all their Tallink shares to ESCO and in 1994 the company merged with Estonian based company called Inreko which has operations on Helsinki-Tallin route with one ferry ship and two hydrofoils. The name of the new group was also changed to AS Hansatee Grupp. Later in the mid 1990's the company sold its two hydrofoils to Linda Line which helped in the company acquiring more vessels to operate between Tallinn-Helsinki route. They saw a significant increase in amount of Finnish passengers on board who accounted for 80% by 1995. By 1997 due to the demand the company also started a cargo route from Paldiski (Estonia) to Kapellskär (Sweden). In the same year the company ran into financial difficulties and ran into the verge of bankruptcy. The company was offered to be sold to Silja line and Viking line and since both the companies declined, the company got more loans from the bank and continued its operations.

In 1999, AS Hansatee group got the rights to use "Tallink" brand name. Later, In the year 2001 the group acquired two vessels from Estline to expand its operations to Tallinn-Stockholm route (Estline 2013). In 2002, AS Hansatee Grupp changed its name to AS Tallink Grupp and acquired newly built vessel M/S Romantika which was used between Helsinki-Tallinn route. (Huopana 2013)

As the operations increased the group opened newer routes such as Helsinki to St. Petersburg which was later discontinued, Tallinn to Stockholm, Stockholm to Riga etc. The group went for modernisation during 2007-2009 by bringing newer vessels into service and increasing routes between Helsinki – Tallinn which made the travel between these two fast growing capitals less than 2 hours. The group later also ventured into hospitality sector and on demand taxi service called 'Tallink Taxi'. In the years 2010-2013, Tallink Silja shifted its ships between various routes, making its operations more effective in both costs and efficiency, In 2013 the company bought a former Viking Line boat, the M/S Isabella (renamed M/S Isabelle) and used it between Stockholm – Riga route to better satisfy the route's needs (Tallink Grupp 2013). From the year 2013 Tallink Grupp saw a dramatic increase in number of passengers transported and revenues. For Example, in 2015 the group posted an all-time high revenue of €945.2 Million and in 2016 the group announced a record number of 9.6 million passengers being transported on board of Tallink group's ships. As the time progressed the group found more efficient and eco-friendly ways to transport passengers. A best example for this increased usage of LNG powered ferry called Megastar that transported 2 million passengers in its first operational year.

3.1.2 Tallink Grupp AS structure

According to the Tallink Grupp (2018) year book, the company describes itself as "A leading European ferry operator, offering high quality mini-cruise and passenger transport services in the Baltic Sea region as well as a leading provider of ro-ro cargo services on selected routes. The Group provides its services on seven routes between Finland and Sweden, Estonia and Finland, Estonia and Sweden, and Latvia and Sweden under the brand names of "Tallink" and "Silja Line". The Group has a total fleet of 14 vessels that include cruise ferries, high-speed ro-pax ferries and ro-ro cargo vessels. In addition, the Group operates three hotels in Tallinn and one in Riga. The Group's subsidiary Tallink Duty Free is a successful international travel retail organisation with a number of shops on board, onshore and online" (Tallink Grupp, 2018: 14).

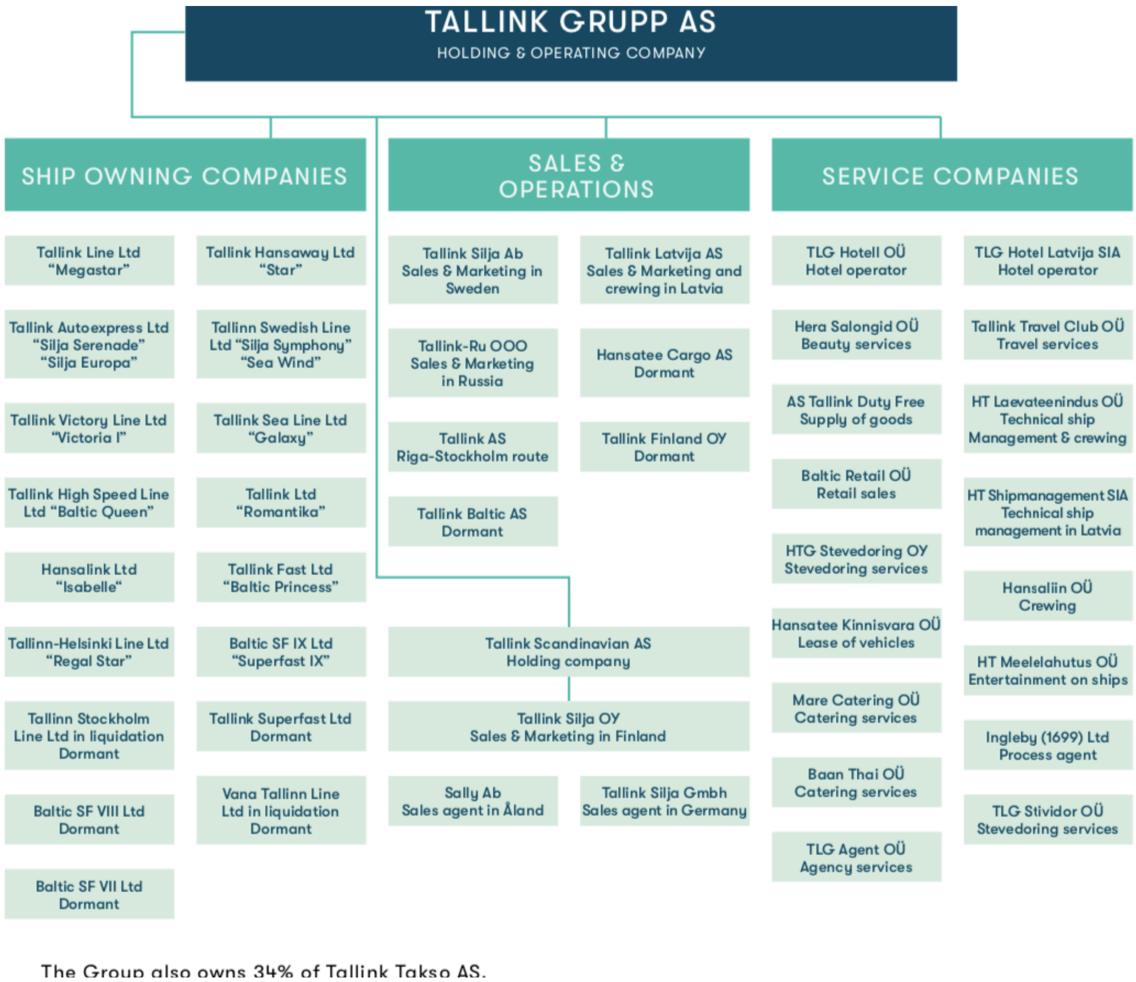


Figure. 3. Group Structure (Tallink Grupp, 2018: 30).

At the end of 2018, Figure 3 explains the structure of the company that consists of 44 ship owning companies and their operational status (active/dormant).

3.1.3 Cruise and Shuttle services

Tallink Grupp emerged as a market leader in Nordic and Baltic region in terms of passengers transported and cargo freight (Tallink Grupp. 2018: 14). The largest revenue generating asset for the group are the cruise ship vessels. The 14 cruise ships owned by Tallink Grupp account for 80% of the company's assets. So it's very important to take a closer look at different vessel services that are operational.

The cruise service of Tallink Grupp comprises of nine cruise vessels and five cruise routes. They connect busy cities with cruise routes such as Helsinki- Stockholm, Turku- Stockholm, Helsinki- Tallinn, Stockholm- Tallinn and Riga- Stockholm. Operational under the brand names 'Tallink' and 'Silja Line' they are one of youngest fleet with constant refurbishments and service enhancements. To give an example Tallink Grupp has invested more than €75 million into vessel renovations and refurbishments from 2014 till 2018. (Tallink Grupp, 2018).

Figure. 4. Tallink Silja's operational route map (Tallink Grupp, 2019: 31).

The launch of shuttle services was aimed to build a floating bridge between the two capital cities of Tallinn and Helsinki. These services are offered by two shuttle vessels namely 'Star' (accommodating 2080 passengers) and 'Megastar' (accommodating 2800 passengers) all year round with 12 departures on a daily basis. The departures scheduling is predominantly focusing on the peak hours at morning and evening to ease the commuter traffic. These shuttles also boast a wide variety and selection of bars, restaurants, cafés to top-of-the-line kids play areas and the largest duty free shopping arena on the Baltic Sea. Apart from the above selection they also have two work lounges in which the customers can enjoy a more peaceful and quiet ambience. The shuttles together transported close to 5 million passengers in 2018 alone.

The group also emerged as the largest maritime cargo services provider in the Baltic sea region, In the year 2018 alone the group transported close to 385,000 units of cargo. The main business model of the group is mixed tonnage or otherwise technically known as ro-ro (roll on- roll off) ships. This is the case when customers and cargo is transported in one go, the major portion of the ro-ro cargo is mainly lorries and trailers. There is also a separate deck for passengers to come on board with their cars and leave at the port of call. As we saw from above the economic progress of a country is fully dependent on free flow of goods and services from one place to another and since the waterways are considered the cheapest form to transport mass cargo, cargo segment in the group takes high precedence. The customer base for cargo carrying services range from large multinational companies to Small and medium sized companies. The group has been actively working towards creating more flexibility and convenience to the cargo passengers and this thesis also aims to contribute towards the same line of thought. (Tallink Grupp, 2018)

3.1.4 City Breaks

The group aims to become an 'experience provider' rather than just a 'cruise company'. In that similar lines the company offers many combinations of services such as golf, opera, museum and theme based cruises that customers can enjoy which makes the trip more memorable than just a regular cruise. The group believes that the customers should be able to experience different amusement and service options from the time the set foot on-board till the time they finish the whole cruise experience which includes on ground activities. They do this by providing different options on board such as shopping, dining options, café's, dance shows and theatre performances.

On the similar lines the group has standing agreements with leading hotel chains in both Sweden and Finland to offer customers affordable accommodation options. The group has 4 hotels aggregating to 1000 rooms in Tallinn and Riga which are operated under the name 'Tallink Hotels'. They combine these rooms with their cruise packages to deliver more value and make it price competent. In Tallinn the group has a total of 3 hotels. The two trendy business hotels Tallink Spa and Conference hotel and Tallink city hotel are situated in city centre where as Tallink Express hotel is located near the port and is often the choice of budget travellers who wants to leave through port to their next destination. In Riga, the capital of Latvia. The group has one hotel named Tallink Hotel Riga which is located very close to business district, shopping centres and the famed old town.

3.1.5 On-board Services

The group has unprecedented rankings in terms of sales on board and services offered. The group is ranked among the third largest in the world and the largest in Nordics in terms of travel retail revenues. They also hold the title for fourth in travel retail outlets in Europe (Generation Research 2017). Let's take a closer look at six different services they offer on board.

To start off with I looked at groups **Duty free sales and Travel revenues** as this not only provides the best value to customers travelling from countries like Finland and Sweden that highly tax on items such as such as alcohol, tobacco and confectionary. It is also responsible for contributing to the highest overall revenues to the group. AS Tallink Duty Free (a subsidiary of AS Tallink Grupp) was founded in January 1997 and specialise in selling fast moving consumer goods, tobacco, alcohol, cosmetics and confectioneries etc. The company is able to sell their products without VAT and excise by utilising the International Maritime Law and with its jurisdictional stops on certain cruises in Åland island. The subsidiary has been operating in different business models both on shore, off shore, e-shops and by taking advantage of the parent groups infrastructure. The company also has one of the largest retail spaces on the sea accounting to 15,000 sqm of shopping space on board the groups ships. Apart form that the company also has 47 shops across 11 ships and 13 onshore shops in different cities. The group also has franchises in the Baltic region to established fashion brands such as Vero Moda, Jack & Jones, United Colors of Benetton and Espirit to name a few. The main competitive edge that the group has to offer the services in a very efficient manner is their centralised supply chain management which takes advantage of existing infrastructure and gives better service. The group also offers off board taxi services in Tallinn under the brand name **Tallink Takso**.

3.1.6 Club One Loyalty Programme

Established in 2003, the company was able to leverage the services provided through a loyalty programme called 'Club one', which is a tier based rewards programme. This loyalty programme has a base of 2.5 million customers coming from a range of 150 countries and predominantly from countries such as Estonia, Sweden, Finland and Latvia. This programme is designed to benefit the customers both onboard the groups ships and off board in their various service offerings. The company prides itself that it is able to offer its loyal customers close to 500 active benefits at any given point of time.

The programme works on customers being able to earn bonus points every time they travel on board one of their ships or have a meal in one of their restaurants, make purchases onboard or offshore in any of their retail outlets and on their webshops, avail any services by Tallink hotels or using Tallink Takso services, Utilise any fitness services at their Tallink Tennis and Fitness centres. They also partnered up with select third party vendors to offer their customers a best overall experience. In the year 2017 the group started issuing digital loyalty cards and urged all their customers to use them and as of 2018, the default loyalty card for 'Club One' was only a digital one unless otherwise requested so. The main aim of the loyalty programme is to create value to their loyal consumers by streamlining their service output and creating a smoother experience (Tallink Grupp, 2018)

3.1.7 Summary of Tallink Silja as a brand

The Evolution of Tallink Silja as a brand has quite a historic significance impacting various stakeholders of Baltic nations such as Estonia, Finland, Sweden and Latvia. Summing up from the history, the association of two historical companies namely, The Finnish steamship enterprise which began its operations from Finland in 1883 transporting cargo and vital services to Estonian based Tallink Grupp AS which was a joint venture of two companies Palkkiyhtymä Oy (Finnish company holding 40%) and Estonian based company called Eesti Merelaevandus RAS (ESCO) (holding 60%). Both companies played a very pivotal role in maritime sectors in their respective countries and in April 2006, The Estonian company Tallink Grupp AS acquired the competitor Silja Line forming Tallink Silja Line (Dumell, 2007).

Since the rebranding of Tallink Grupp AS and Silja Line into Tallink Silja Line. The group grew quite strongly amidst competition and new legislations by transporting more passengers and cargo than anyone year on year. As of 2009 the group had 14 vessels altogether. In which 12 are used for both passenger and cargo transportation otherwise also known as Ro-Ro ships and 2 of them used exclusively for cargo transport inside the Baltic sea area (Tallink Grupp, 2019)

According to Mańkowska, M. (2015) analysis, The Baltic Sea is one of the leading ferry markets in the world. In that same segment Tallink Silja was able to come out as the market leader. This was the combined result of the companies quality offerings and a clear value added utilisation of resources at hand to create a easy to use solution for its consumers. The brand outlook although is seen by many domestic and international customers as a predominant passenger and cargo shipping company. The company made strides to offer many more services such as duty free sales, cleverly placed hotels which can add value to the cruise packages and finally taxi services to complete the whole loop.

These many services were able to distinguish "Tallink Silja" as generally a higher quality cruise company compared to the counter parts.

3.2 Outlook of the problem

The thesis was an output for the demand of Tallink Silja Oy Cargo department which is a subsidiary of Tallink Grupp AS. As I have already established that Tallink Silja operates Ro-Ro ships from different ports in the Baltic Sea. One of the ports they were operating from namely Länsiterminali (West Terminal) which is located in Länsi Satama (West Harbour), Helsinki. It is managed by the Port of Helsinki and was given a mandate by the City of Helsinki to vacate the exisiting parking area which was rezoned for residential, office and mixed use spaces. So the Port of Helsinki had to come up with solutions for faster check-in of cargo and passenger traffic into the ships thereby reducing the loading times and increasing the efficiency with other benefits mentioned below (Port of Helsinki, 2016).

Apart from the need to digitalise the port operations (Carlan et al., 2017), there were also other operational problems observed from the perspective of Tallink Silja Cargo at the Helsinki port such as high amount of paper wastage, poor communication between truck drivers and the company, high cargo waiting times creating inefficient use of resources and pollution, lag in information exchange and drivers lack of digital competence

The need to improve operational efficiency was not only from the standpoint of Tallink Silja's cargo, but was also in line with the City of Helsinki's vision to plan to develop the Länsi Satama (West Harbour) located in Jätkäsaari. Jätkäsaari is located facing the sea and on the south west of Helsinki. It was a predominant shipping and cargo port area, until the City of Helsinki decided to make use of the beautiful sea views and turn it into a residential and mixed use area to accommodate rapidly developing urban infrastructure and also increase the revenue of City of Helsinki. The envisioned plan is set to continue for the next 9 years until 2030. The area of Jätkäsaari is close to 100 hectares in size and the City of Helsinki wants to utilise it to develop urban housing and implement smart city concepts. The aim of the city is to provide housing for 16000 residents and facilities for close to 6000 people to work in. (Tiilikainen, 2018)

City of Helsinki along with its plan to urbanise Jätkäsaari, has also an elaborate plan to ease the congestion in the area due to rapidly increasing sea traffic and residents commute. To give a brief idea, Jätkäsaari is 3.6 km's away from the central railway station and 2.6km's from Kamppi and City Centre shopping mall. Through Kamppi and Central Railway station the rest of the cities in Finland are well connected through trains and busses. To reach the bus and train station areas the passengers have to take a tram from the port to the central train station by either tram numbers 7 or 9. These two trams serve terminal 1 and 2 of west harbour port to the city centre. On ground, during the rush hours and the passenger arrival times, the traffic between Jätkäsaari and city centre is not only hectic but also challenging and busy.

The main focus or prevailing vision is to make the transportation to and from Jätkäsaari as smooth as possible. There were multiple reasons for this, West Harbour being one of the main ports of operation for Eckerö Line, St.peterline and Tallink Silja brings the highest traffic in terms of cargo, trucks and passengers from other countries into Finland. If the volumes are taken into consideration for example, around 4 Milion passengers go through the Jätkäsaari area annually (Helsinki City Planning Department, 2009:8).

Since, The City of Helsinki also envisioned Jätkäsaari to be a residential, commercial and developing urban area. The need for smoother traffic flow, bearable noise levels and efficient transportation systems were key to achieving safe transport option in growing metropolis. In Jätkäsaari there is a focussed plan on also developing cycling and pedestrian pavements which connect with other cycling and walking routes that span across Helsinki.

As mentioned above Länsiterminali (West Terminal) is one of the busiest ports in Finland in terms of cargo and passengers due to its transport connections for Eckerö Line and St.Peterline located in Terminal 1 and for Tallink Silja from Tallinn located in Terminal 2. In 2017, West Terminal 2 (also known as Länsisatama 2) was inaugurated after a much awaited construction of the new terminal. The new terminal was built with a vision of facilitating the fast scheduled traffic between Helsinki and Tallinn. As a result of the construction, the travel experience between these two cities is convenient, smart, mobile, smooth and efficient. To add, the new terminal construction included an array of newer technologies such as new ship quays and auto mooring systems, which improves the sustainability and convenience of the sea travel. The construction was influenced and funded by the EU, Port of Helsinki, Connecting Europe Facility (CEF) and Trans European Transport Network (TEN-T).

The Same stakeholders also promoted the establishment of the Twin Port cooperation between Port of Helsinki and Port of Tallinn. The sea traffic between such cities is one of the busiest in the world. Furthermore, sea travel and shipping is a great contributor to the economy of both cities, in creation of jobs and services. Additionally, connecting Tallinn opens the network corridor to Central Europe, making multiple options such as road and rail transportation available.

As it can be understood from the above, Länsi Satama (West Harbour) located in Jätkäsaari is a significant contributor to the Finnish economy. Apart from that City of Helsinki plans to make Jätkäsaari a part of growing metropolis with wide range of projects that include residential, commercial and mixed space which can be utilised by thousands of residents whilst taking advantage of the gorgeous Baltic sea views. In essence it can be logically concluded that due to the very limited mobile space, the movement of people, vehicles, and cargo should be facilitated very efficiently.

In this thesis apart from the operational challenge faced by Tallink Silja cargo in Helsinki port. I also decided to research every passenger port except couple of specialised cargo only ports in operation (Since they don't have any check in systems in operation). This meant going to each operational port, understanding their current check-in and loading, taking specialised interviews with operational heads of Tallink Silja Cargo in that ports to get a clear and concise understanding the overall check-in situation at all the ports.

Although all the operational ports of Tallink Silja Cargo except Helsinki West Harbour, did not face any immediate challenges to due to rapid urbanisation and expansion. It was very helpful in establishing the overall operational scenarios and suggest solutions based on macro view approach.

3.3 Current Check-In and Loading

Tallink Grupp AS is one of the largest and dominant Ro-Ro (Roll on- Roll off) shipping consortium in Baltic sea. With a fleet of 12 Ro-Ro ships and 2 cargo ships, In 2019 alone the group transported more than 9.7 million passengers with more than a million passengers per month several times in a row. (Tallink Grupp, 2019:8). The group currently operates out of 6 ports through Ro-Ro ships and 4 routes with specialised cargo only operation. I am going to be only discussing about the 6 ports with Ro-Ro operations since they use the check-in and loading facilities and that's where the solutions can also be implemented.

This being said any kind of technological shift towards sustainability can have a very high quantifiable end results and better brand communication towards consumers who are more conscious in their decision making.

The current process or standard operating process of cargo check-in at most ports is described in a detailed way below. I will be going port by port except for cargo only ports located in Paldiski, Käppelskar, Muuga and Vuosaari. As they don't come into the purview of the thesis.

The check-in process starts with the third party logistic company employee (a customer of Tallink Silja Cargo) reserves a time slot over Tallink Silja Line's own check-in software system called "SeaFreight" according to their requirements. Usually this is done one day before departure or in some cases much earlier. The driver then gets the information about the booked ferry from his companies supervisor.

Tallink Silja Line's check-in staff waits for the driver to arrive and then to fill out missing information (paper form of check-in forms used in most harbours) into the sea freight system, checks the drivers identity and hands over the ferry check-in tickets. In this process I observed that the driver has to stop at the check-in office every time before a departure and furthermore the driver can wait at a designated parking spot in the harbour to wait for the ferry. When the loading area is ready before the departure of the ship, the driver then proceeds to the loading area where the trucks are arranged regarding their arrival time, type of goods (ADR / cooling), weight and length. The arriving ship is then unloaded, usually with the responsible personnel having limited knowledge about the situation on board. Afterwards the loading procedure begins. The most critical consideration in the loading phase is the consideration of latecomers. As drivers have currently limited possibility to indicate their late arrival it's difficult for the personnel to make the correct loading choice. Loading and unloading the ship are considered the most time-critical steps, it also has the biggest impact on Tallink Silja Lines ecological sustainability: A reduced loading time means a slower travelling pace for the ship which reduces the amount of fuel needed drastically

Now that I established how the cargo check-in standard operating practice, I can now further explain in detail how it is done port by port and discuss the need for new technologies is currently needed or not.

3.3.1 Helsinki

Tallink Silja operates out of two ports in Helsinki city. Firstly from West Terminal or also known as Länsi Terminaali and Olympia Terminal. I take a closer look at the current check in practices in both the ports operated out of Helsinki

West Terminal which is located in Jätkäsaari area and is one of the major operational ports for Tallink Grupp, as the express Ro-Ro ships such as Star, Europa and Mega Star operate from here with a total frequency of 6 times a day to Tallinn, it is understandable that these two ships are responsible for high passenger and cargo traffic. The problem or the need for check-in solutions is the most predominant in this port of operation as the city of Helsinki decided to rezone otherwise assumed or currently used parking area. (Helsinki City Planning Department, 2009). The current check-in process is that Trucks come from the main highway and park at a designated parking area which is also shared by other companies operating out of the same harbour such as Eckerö Line. The check in office is located right beside the parking area in a small portacabin where the driver fills out all the details in a paper form as mentioned above and presents it at check-in office. After the check in officer confirms the truck details are correct, they will be issued with a ticket, which will be used to enter west terminal 1.5 hours before the ship departs and park in a designated area which will be assigned or shown to at the parking area by the ground stewards. (Purho, J. 04 Jan 2018)

Olympia Terminal or also known as South Harbour is located by Kaivopuisto park area and is the second base of operation for Tallink Silja and its bay for longer cruise ships. Tallink Grupp ships called Symphony and Serenade operate from here mainly to Stockholm with a stop in Mariehamn. The check-in situation is quite simple in this port that the trucks enter from one lane at the start of the port and the barriers only open if the truck license place is registered in their systems. Then they come inside the port, stop their trucks and go into the check in office to fill the form and take the ticket. The trucks that come here also used the parking space in West Harbour port to come before hand and rest there. In the Olympia terminal however there is not so much of a problem since the daily movement of ships is quite low compared to West Harbour and it is also quite strategically planned breaks between each ships check in time.

In essence we can understand the following. Firstly, the check in systems of Tallink Cargo in the ports of Helsinki are very traditional and has certain drawback's to it such as less efficiency, more start and stop times for trucks leading to higher pollution, paper wastage and delays in check-in and loading. Secondly, out of the two operational ports which require check-in technologies, West harbour has more urgency to come up with technological solutions to improve the traffic movement and increase the transport efficiency.

3.3.2 Turku

Tallink Grupp's second hub of operations in Finland is from the Port of Turku which is located in Linnakatu 91. The port is has quite a historical significance and even today is one of the most important gateways to the west in terms of trade, tourism and culture. Out of this port the Tallink's ships Baltic Princess and Galaxy operate mainly to Stockholm with a stop in Åland Islands. Both this ships are of Ro-Ro (Roll on- Roll off) classification, taking passengers and cargo at the same time. As the focus of the thesis is mainly on cargo check-in, I looked at that more deeply. Tallink has a separate terminal in Port of Turku which is quite helpful with the handling of cargo. At the time of the interview, it is to be noted that the check-in systems are manual similar to the Helsinki port.

The trucks or cargo arrives into the port and parks at specified cargo parking area at the port. They stop their vehicles outside and go into the cargo office with their CMR and a personal ID to fill in a check in form and the check-in clerks will help them after verification to fill in the weight of the cargo, type of cargo, destination of the cargo and the driver details. After this the clerks printout the check-in ticket and open the gates operated manually by a button at the control of the clerk. Since there is enough parking at inside the port before ship departs and between each sip departures, the trucks already get inside and starts queuing to be loaded into the ship with the help of ground stewards in coordination with CLO (chief loading officer). (Lehtonen, H. 29 Dec 2017)

In essence the following could be understood, the port of Turku has a very traditional check-in system in place, but since there is enough parking space for cargo with no plans for the city of Turku to change that as its zoned permanently. The implementation of new check in systems is not imperative in this port, but can lead to better efficiencies and a smoother and coordinated check-in process in the future. (Lehtonen, H. 29 Dec 2017)

3.3.3 Stockholm

The Stockholm port is the major port of operation for Tallink Grupp in Sweden. The group operates to four destinations from this port such as Helsinki, Turku, Tallinn and Riga, so it could be seen as another major port for groups longer travel trips. The port is 21 minutes away from the Stockholm city centre and is easily accessible by cars and trucks. The Port of Stockholm is the parent organisation which consists of number of ports such as Värtahamnen, Frihamnen, Stadsgården and Skeppsbron. Nybrokajen and Strömkajen are centraly located and are mostly used for local passenger traffic by other ferry companies such as Viking Line. Värtahamnen and Stadsgården has wide ferry traffic for goods and also passengers to and from Finland and other Baltic States. Stadsgården, Skeppsbron and Frihamnen are the ports preferred by the global cruise liners mainly in the summer season. Värtahamnen also house vital facilities in order to supply oil and fossil fuels to Stockholm. Facilities for loading and unloading sand, cement and fuel pellets are also available within Stockholm port areas.

The check in process at the port is the following, there are two lanes for cars and trucks to come in to the port from the city. Lane 1 is for trucks and lane 2 is for cars. After the trucks and cars enter the port through these lanes, proprietary check in software and cameras recognise it through the number plates and the gates automatically open.

After the gates open the vehicles need to line up inside before the departure. There are 13 different lanes again which are classified into different categories for different departures. Drivers are generally not allowed to park trucks inside the check-in area for longer time, so they pull up close to the port and park in nearby under developed area and truck laybys . They only come here very close to the check in time or night before when the ship departs early morning.

The trucks specifically which are going to Helsinki, Tallin and Riga are then checked-in one by one into the port area according to the schedule of departure. Control of check in gates with clear digital signage markings are shown inside this port check-in area. Once the cars finish lining up in their designated zone they are finally funnelled to the departure ship through 2 lanes for cars and trucks.

This port is much newer in terms of operational age. It has already built in technologies to facilitate smooth check-in process. So, I can safely say that new check in technologies are not needed for this port. But during the interview I also found that they are some inefficiencies such as trucks coming before their designated time inside port and leaving their cargo there which creates traffic congestion and while loading some ground inefficiencies. Tallink could easily address these issues by optimising certain systems, which they are already planning to do so. (Nikolics, B. 30 December 2017)

3.3.4 Riga

The Port of Riga is a significant hub of cargo transportation corridor that links production of goods and consumption markets in the EU and the CIS states. The Port of Riga is deliberately associated to the TEN-T road and rail network, as well as to the European Motorways of the Sea, providing effectual use of different modes of freight within transport chain as well as cost optimization.
Shorter distance advantages of Riga as compared to the neighbouring ports guarantee the best conditions for economic relations developments between Latvia and its EU counterparts. Latvia border with Russia and Belarus and that is one of the main factor for development of sustainable and mutually beneficial business relations with those countries.

The Freeport of Riga is a multifunctional port, it is ready to handle all kinds of cargo from different regions. In 2013 cargo income at the port reached 35.5 million tons. By throughput of cargo, Riga is the largest Latvian and the Baltic States port, handling around one fifth of the region's total cargo turnover. The Freeport of Riga offers year-round navigation.

Although Riga might be cargo epicentre for some shipping lines, In the case of Tallink its just an operational port with routes mainly departing to and from Stockholm. In the port known as 'Riga passenger terminal' the birth where Tallink operates is exclusive to the shipping group except in summers where bigger passenger cruise liners also use the same berth.

As there is a limited schedule of ships that operate from this port. In our visit to the port I found out that the ticketing for truck start at certain time depending on the schedule of ships departure. The check-in process at the Riga passenger terminal is the following, there is a check in gate at the start of the port which is manually controlled by the tallink personnel. The cargo vehicle stops before the entry gate the driver goes inside the cargo office and manually checks-in with the tallink personnel who will hand them a printed check in ticket after they submitted their check in form filled with all the required metrics mentioned in the 'current check-in and loading'. (Zeps, I. 02 January 2018)

After that the truck driver gets into his truck and drive towards the check-in gate which is opened by the personnel who just checked-in the truck by verifying their arrival on CCTV and press the button to open the gate. This completes the check in process and they drive inside to the parking bay. In the parking bay, the starting lanes are reserved for trucks and the rest are for cars. As this port is only reserved for Tallink ships during most of the year. The loading is done in manual way with help and co-ordination with ground staff and CLO. (Zeps, I. 02 January 2018)

3.3.5 Tallinn

The Tallinn Passenger Port is the chief passenger harbour in Tallinn, Estonia. Regular lines serve routes to Helsinki (Finland), Stockholm (Sweden) and St. Petersburg (Russia). Old City Harbour is one of the five ports within the state-owned company Port of Tallinn. It is one of the major and fullest passenger harbours globally and also the biggest passenger harbour in Estonia.

It operates three passenger terminals (A, B and D), total length of its berths is 4.2 kilometres. Vessels with a maximum length of 340 metres, 42 metres wide and draught of 10.7 m can enter the port. In 2019, the port aided in the transport of 10.64 million passengers. The port is also operating 339-metre-long quay planned for cruise ships. The number of the cruise passengers is increasing progressively, also by the application of reversals in cooperation with Tallinn Airport. For coping with that numbers and increasing size of the cruise ships arriving in Tallinn, Port of Tallinn started in May 2013 the construction of the new quay next to the existing cruise ships quay in the Old City harbour.

The total length of the quay built by the Estonian branch of BMGS is 421 metres. With the new quay, the Port of Tallinn is able to moor cruise ships up to 340 metres in length, up to 42 metres in width, and with the draft of up to nine metres. The total cost of the project was 9.34 million euros. Likewise, Old City Marina - a new harbour for leisure vessels formed in 2010 which is a part of Tallinn's Old City Harbour. On 29 September 2017 at the EU Digital Summit in Tallinn, a partnership of Ericsson, Intel and Telia Estonia proclaimed that they had applied the first live public 5G network in Europe at the Tallinn Passenger Port to connect with Tallink cruise ships at the port.

Tallink Grupp originates from Estonia and the group was very influential in shaping the shipping legislation and their trade decision making of the country. The whole of Terminal D port is the operational headquarters of Tallink Grupp. There are dedicated offices, check-in ramps, proprietary queuing systems which are tailor made for the group. The check-in at this port is done so that the bus driver gets down and gives the filled form to check in officials. After the truck driver gets the check in ticket, there is plate tracking technology throughout the port that directs them to their relevant lanes. The truck drivers also know at what time they need to start their loading and will plan accordingly.

The terminal has a total of 15 operational lanes currently and 32 more lanes being built, which are due to be completed in the leading five month during the time of the visit. In the port area there is a queuing lane with the length of 9000 meters for the trucks to park during the loading times. At this terminal there are 4 parking quays for Tallink ships to operate from in which normally 3 are used most times. Another interesting observation at Tallink port is the Ro-Ro ships which operate from this port load and unload the cargo from front side of the ship which is single lane whereas at other ports they load an unload from back side which has 2 lanes, this is due to the fact that since Tallink has exclusive operational base at this terminal, the loading and unloading is not time sensitive whereas at other ports they need to check-in and check-out as quickly as possible.

The port was also working on smart technologies implementation called ‘Smart Port’ system which was in co-ordination with GS1 technologies. This technology is made in such a way that it can also be implemented any other operational port. The truck comes into the port and goes to weighing area which has a host of sensors which automatically determine the length, weight and type of cargo etc. Then the driver has a computer screen right outside the truck window in which he should enter his booking number and other details such as ID and tick all the questions asked and the truck is checked-in automatically. So after doing that the digital signage shows which lane to park in according to the departure ship schedule. This technology helps decrease the trucks waiting time, start and stop time and efficiently moves large number of cargo units from the port.

4 METHODOLGY, RESEARCH ANALYSIS AND SOLUTIONS

This thesis by design is qualitative in nature. I structured the research methodology with keeping in mind that the thesis as a multiple case study analysis comparing different ports and understanding how they differ from each other and how I can offer solutions to the most important problem that they can actually implement in reality and have positive implications for the company with complying with their future vision.

With this in mind, the research methodology is further divided into 2 sections.

4.1, Under 'Research Design and Data Collection' I discuss about how the research was designed and what were the pre requisites that are taken into consideration. The origin story and how I approached the solution to the problem theoretically using research and analogy. It is further divided into two more subsections which are,

4.1.1 Interviews, where I physically went to all the ports at agreed dates to interview assigned cargo department personnel who not only helped me understand better the ground situation but graciously offered to show me the whole port around as if it was a truck with cargo coming to check-in and finally answered my prepared set of questions in an audio recording.

In 4.1.2 'Investigative Questions', shows the set of questions that were designed and prepared beforehand with keeping in mind the aim of observing 'multiple themes' that come out of these questions at each port.

The section 4.2 contains 'Port Visits and Interview Analysis' describe in detail about the five ports I visited. The main aim of the section is to transcribe and analyse all the answers to the investigative questions asked and answered at each port. Starting with Helsinki, Tallinn, Stockholm, Turku and Riga.

4.1 Research Design and Data Collection

The master's thesis is a collaborated effort with Tallink Silja Line, the company providing passenger cruises and ro-ro cargo services in the Baltic Sea area. The research is designed to tackle the field of ro-ro cargo services although some parts of the solutions could be implemented in the passenger check-in and loading as well.

Tallink Silja is providing cargo services in selected routes between different harbours located in Finland, Sweden, Estonia and Latvia. The business environment of Tallink Silja is changing and especially abolishment of the parking places for the trucks in the harbours such as Helsinki's west harbor forces the company to re-organise their check-in and loading procedures In order to tackle these challenges our tasks are to create more sustainable procedures for effective check-in and loading routines of cargo units to ships sailing in the Baltic Sea.

The thesis was a byproduct of my participation in a maritime talent competition called 'Intelligence Hunt 2'. This talent competition had 13 real case companies, 25 student teams with company representatives, 4 inspiring industry speakers, 1 Key Note Speaker and an international jury. It was held on 14th November 2017 on board Tallink Silja ship Serenade with participating companies such as Finnlines, Arctech Helsinki Shipyard, Climeon, Port of Helsinki, DFDS, Stena RoRo, Steveco, NESA, Tallink Silja, MacGregor, Varova, MONDI and SeaFocus.

I was part of a group with 3 other talented students from different universities who were equipped with different educational qualifications to bring their own unique expertise to the table. I presented our findings and research after thorough understanding of on ground situation. Our supervisor, Marina Hasselblat from Tallink Silja Cargo was quite satisfied with it and appreciated us for presenting our solutions.

After the Talent competition, I thought to myself why don't I use this case study to better understand the problem in detail and maybe provide a thesis which has practical business implications and real life impact. After consulting my thesis supervisor Juha Kansikas, who mentioned it was a very good idea.

Since thesis from our university are generally not done on shipping companies as our university is quite far from the sea area and there are practical implications of going to the ports and interviewing different personnel to get the best output. After I got the go ahead from my academic thesis supervisor. I approached my Tallink Silja mentor Marina Hasselblat and asked if I can do this as my master's thesis topic and if she could be my supervisor on behalf of Tallink Silja, she gave me an encouraging go ahead with a good list of candidates for my next part of the research.

I started off with firstly deciding the dates and people to interview at different operational ports. Next, I was given time to prepare my very own set of investigative questions to ask the interviewees at the visited port to complete my multiple case study analysis. This was done in as a pre understanding context to better analyse everything in detail and suggest solutions based off the research.

4.1.1 Interviews

The research design started off with a trip around different operational ports of Tallink Grupp with assigned interviewees. This was possible thanks to Tallink Silja cargo and my supervisor Marina Hasselblatt who was able to arrange the necessary travel arrangements at all the ports including the right people to interview.

I started my Interviews with Turku Harbour on 29 December 2017, next I reached Stockholm port on 30 December 2017 where I finished my interviews for the port. Although I departed to Riga the same day, since it was new years the cargo manager who gave me the interview was on a holiday, so we scheduled it on 02 January 2018. Later I went by road from Riga to Tallinn and interviewed the port personnel at Tallinn on 03 January 2018. Finally, on 04 January 2018 I reached the Port of Helsinki where my interviewee Jesse Purho gave a detailed tour of the port. Although we did it once before this time we had a chance to look at other port of operation which is Olympia Terminaali.

After all the port interviews, Corona pandemic broke out and hence it was hard to go to ports to get interviews due to the restrictions in place by the government. I got the interviews and information for my thesis by via online Teams meetings with Sakari Montonen (2020) from the Port of Helsinki and Janne Kortesmaa (2021) from Tallink Silja to fully complete my thesis.

Below is an illustrated timeline table with all the Interviewees and the Port/Topic information they helped me understand.

Date	Name of the port	Interview Person
29.Dec.2017	Turku Harbour	Heidi Lehtonen
30.Dec.2017	Stockholm Port	Benita Nikolics
02.Jan.2018	Riga	Ivars Zeps
03.Jan.2018	Tallinn	Jürgen Mäelt
04.Jan.2018	Helsinki	Jesse Purho
08.Sep.2020	Port of Helsinki	Sakari Montonen
07.Jun.2021	Smart check-in	Janne Kortesmaa

Table 4.1.1 Interviewees and Port/Topic information

4.1.2 Investigative Questions at Ports

After creating a schedule of interviews and whom to interview at what ports. I created a series of nine Investigative Questions that were answered by the cargo in charges of port operations for each Tallink operated port.

This was done to standardise the research methodology and create a linear answers through every port for better analysis and understanding. This was also helpful in establishing that my thesis was a multiple case study analysis looking at different comparative metrics in the same field.

Taking that into consideration let us look at the Investigative Questions asked at each operational port.

1. Name of the port?
2. What is the current cargo check-in process place?
3. Did the city give mandate to vacate the parking spot and by when?
4. What is coming up in the existing parking place (If any knowledge)
5. Any other parking spots in place for easing the congestion of check in provided?
6. If Tallink Silja comes up with a new system of check in, can it be enforced in that port?
7. Preference for common check in system or individual check in system at the said port?
8. Any system for loading the cargo into the ship other than manual ground force (stewards) in co-ordination CLO (Chief loading officer)?
9. LNG bunkering facilities available at the said port or is there space allocated for it in the future?

4.2 Port Visits and Interview Analysis

In the sub sections I elaborate on what was told during each interview. This was done analysing and transcribing the audio recordings done at each port. Although the interview process started in Turku, Helsinki was featured first due to its significance to the thesis.

Let us take a closer look at each port in detail.

4.2.1 Helsinki -

The operations from Helsinki are quite significant to Tallink Grupp and it is also the main case study port for this thesis. There are 3 operational ports in Helsinki for the group. Two of them operate as Ro-Ro (Roll on-Roll Off) ports which I will be taking closer look at, as the solutions will mostly be implemented here and one of them operate as a pure cargo only port.

The operations of Ro-Ro in Helsinki are facilitated by firstly West Harbour located in Jätkasaari and South Harbour located in Olympia Terminaali. The West Harbour is a significant one as the port operates multiple departures a day mainly to Estonia in shuttle ships. Whereas South Harbour operates for longer frequency cruises where the aim is not quick transfer to the city but a more relaxed cruising experience.

So the search for optimisation solutions are much greater in West Harbour than compared to South Harbour. This was only made even more complicated and imminent when the City if Helsinki decided to rezone the parking area of West Harbour and making it into a thriving metropolis for the Urban Population of Helsinki.

On 04 January 2020, I had the opportunity of personally visiting the groups 2 operational ports and ask my Interview questions to Sakari Montonen. He was able to provide me with and in depth understanding of operations as they face problems in not fast tracking the check-in processes. The Investigative questions were asked in an audio interview and the answers are transcribed below. This not only gives a further understanding of the port situations on ground but also helps compare the other ports where the group operates out of.

1. The name of the port of Helsinki. Unlike other city (or) port of operations, there are two operational ports namely West Harbour and South Harbour which are both located in the centre of Helsinki urban area.

2. The Current system of check-in is that the cargo drivers park their trucks in front of check in office and they come inside the office to fill and form and check in their truck by giving all the necessary information. Once the tickets are given, the drivers then drive their cargo to the ship.
   When they get to the check-in gate, In South Harbour the camera automatically recognises the vehicle and opens the gate. Whereas in west harbour the operator who just gave the ticket has to see it through cctv and manually open the gate. Hence to better facilitate the movement of cargo transport an optimised check-in solution is needed.

3. In the October of 2018, the City of Helsinki has informed the West Harbour that the current empty space beside the check-in office which was being used as a temporary parking space and layover for cargo trucks will be rezoned into urban utility areas with various buildings which provide facilities such as houses, offices and retail spaces in turn creating better revenue for the city.

4. As mentioned in the previous question the City of Helsinki has planned for and already invited various companies to look into developing the area with multiple well designed buildings which will provide housing, office spaces and retail areas for growing population.

5. In the case of Helsinki, there were various other discussed options such as using Vuosaari bay area as a temporary parking spot where the truck drivers who need to arrive early can come and park their trucks but nothing materialised or not put in action due to certain restrains.

6. In the Port of Helsinki, a new check-in system can be enforced as the port management also wants to achieve an optimised check-in procedures to better facilitate cargo transport. This being said, there is no procedural guideline yet, so the company and port of Helsinki has to figure out how to achieve this together.

7. The preference here is for Individual check-in system as there are multiple stake holders operating and everyone wants to protect their data.

8. No other procedures set in place other than the one mentioned in the question.

9. Currently no LNG bunkering facilities in Port of Helsinki at the moment, but in the future they aim to introduce it. Currently all the LNG filling is done at the Tallinn Port before departure.

4.2.2 Tallin

Tallink Grupp originates from Tallinn, Estonia. So it is also understood that the group headquarters is located there. There is a dedicated terminal for the company's operations in the Port of Tallin which is Terminal D.

On the Day of the Interview Jürgen Mäelt with his colleague was kind enough to show me every aspect of check-in and port operations along with answering my Investigative Questions in an audio interview. At the time of the Interview Tallink Grupp was also experimenting with their Smart Port (Tark Sadam) technology, which will in near future be used for optimising and efficiently checking in cargo and passenger car traffic. Below is a detailed transcription and answers given in the interview.

1. The name of the port is Port of Tallin, Terminal D. It is an exclusive terminal dedicated only to the operations of Tallink Grupp.

2. The cargo or the trucks arrive at the parking area of the port, goes to the office, submits their prefilled forms with all the necessary information and gets the printed check in tickets. Once this is done, the gates open automatically recognising the number plate and they are directed to go to their designated queuing area before the ship departs.

3. As the Terminal D is exclusive to Tallink operations, no such mandate was given. The port also has some more area in case the company wants to expand, but currently there is no such mandate and the parking space is sufficiently enough.

4. The question is not applicable for this port.

5. The question is not applicable for this port. The current parking space is more than enough for the smooth movement of traffic, the interviewer felt that it would also be good to have efficient technologies that can smoothen and process the check-in speeds faster.

6. The answer was 'Yes', as the Terminal D is dedicated to only the Tallink ships operations they can definitely experiment and implement their own technologies. In fact at the time of the interview, the company was experimenting with Smart Technology for faster check-in.

7. The preference in the case of Port of Tallinn was for a common check-in system that can be implemented throughout the terminal.

8. Currently, the on ground situation is that the loading of the cargo into the ship is done manually by ground force (stewards) in co-ordination CLO (Chief loading officer). In the near future they want to use the smart port technologies to automatise the check-in process.

9. Yes, the LNG bunkering facilities are very much available. Port of Tallinn is currently the refuelling hub of Tallink shuttles and any future LNG equipped ships that the company operates.

4.2.3 Stockholm

The Stockholm port is the base of operations for Tallink Grupp in Sweden. It is one of the very important hubs for the group in terms of leisure and commute cruise. Tallink recently moved the operations of its ships to the newer Värtahamnen port. Although it is comparatively far from the city centre. The close access to Norra Länken or the northern link gives it a very good advantage for easy commute of trucks, cargo and car traffic.

The newer terminal is equipped with inbuilt technologies which help in efficient check-in and well-marked lane queuing of the cargo as well as car passenger traffic. On the day of the Interview Benita Nikolics was kind of enough to take me around the port and show the operations and check-in methods, this also played a major part in suggestions of solutions for efficient check-in. Let us look at the transcription of the audio interview for the Investigative Questions.

1. The name of the port of Stockholm Värtahamnen Terminal which was very recently opened with equipped technologies.

2. As the port has embedded technologies we can see the differences of how the check-in process is done in this terminal. The driver comes in to the port from Norra Länken and the gates open automatically cross referencing if the truck is already entered into check-in manifest. Once the driver enters the port he stops at the check-in office to fill out the paper form with all the necessary details and they will give the driver a check-in ticket along with a code. Once the time of departure comes is near, the driver then goes to the gate and enters the code for the gates to open. After the gates open, the driver stops in the designated marked lines before boarding the ship following the stewards orders.

3. The question is not applicable for this port.

4. The question is not applicable for this port.

5. There are extra marked spaces for trucks arriving way before check-in times, In the interview it was also mentioned that sometimes truck drivers leave their trucks in the check-in waiting area, creating bottle necks sometimes for the arriving cargo traffic.

6. The Värtahamnen Terminal already has check-in systems in place and Tallink Grupp has successfully embedded their check-in technology with the port technology. In a sense this question is not applicable in this case.

7. There is already an existing common check-in system in place with the option of ship operators integrating their software. Another interesting procedure in place is the Colour coding which is done in Stockholm, the colour Red indicates the Tallin departures, Yellow is used for Helsinki departures and the Green is used for Turku departures.

8. No, as there are marked dedicated lines for each type of cargo classification, the trucks or cargo parks accordingly and only during the boarding time is when the stewards come to help with loading.

9. Yes, LNG bunkering facilities are available at this port.

4.2.4 Turku

The first port of visit in the thesis interviews was Turku Harbour. Tallink Grupp has its own bay with its own check in office for passenger check-in and boarding beside other operators in the same Turku Harbour area. Whereas the cargo check-in is much more segmented and reserved only for Tallink operated ships.

This port is important to Tallink grupp in terms of its location. It offers the advantage to the group in a sense that ships can stop off in Åaland Islands and continue their final voyage to Stockholm and back. This not only helps the economy of Åaland Islands, it also gives easy access to travellers wanting to go to Helsinki or Stockholm from the island.

On the day of the Interview, Heidi Lehtonen patiently answered all the questions and later took me around the port to show how the check-in and port operations are actually done.

1. The name of the port was Turku Harbour.

2. The Truck drives into the harbour, stops their vehicle and then goes into check in office. Once the required details are filled and the id is checked the driver will be issued a ticket to get inside the port. When the time of the loading is close, the truck driver goes to the gate and the gate is lifted manually by the check-in operator using CCTV live feed and cross referencing if the truck actually checked in using the license plate of the truck.

3. No, there is no mandate to vacate the parking area of cargo. Although, the City of Turku is planning on creating a parking bay for small cars and

commuter busses as its required there. It is to be noted that this is in planning phase only.

4. As mentioned in the previous answer, there are plans being discussed by the City of Turku for building parking structures but it is in discussion or planning phase as of now

5. Yes, if Tallink comes up with a new technology for check-in. It can be enforced in the port.

6. In the Turku Harbour there is no immediate need or want for easing the congestion as the harbour has enough parking area and queing area before loading into the ships.

7. The preference in this harbour is individual check-in system, as the area is solely dedicated for Tallink ships movements.

8. There are no other systems other than loading of the cargo into the ship manually by ground force (stewards) in co-ordination CLO (Chief loading officer)

9. Yes, there is a dedicated space for LNG bunkering facilities available at Turku Harbour.

4.2.5 Riga

The Riga Passenger Terminal is part of the Freeport of Riga which is the biggest operational port in Latvia and the gateway to the countries trade and commerce. The Riga Passenger Terminal is exclusive dedicated to or used by Tallink Silja except during the summer season where the cruise ships coming to Latvia also use the port for leisure tourism.

This gives Tallink ships a certain degree of freedom to operate in the port and as the port is big in area and traditional in operation. I also observed that the check-in process is more traditional manual operation than more technology embedded.

On the day of Interview, Ivars Zeps, cargo service manager has graciously answered all the interview questions asked and walked me around the port operations to get even a better idea of how the check-in is done. On the interview day the traffic was not high since the next departing was the next day.

1. The name of the port is Riga Passenger Terminal which is part of Freeport of Riga.

2. The truck driver drives inside the port area which has no restriction to enter and stop on a 2 lane road before the check-in office, enter the office and fill pre required details are and after the id is checked, the driver will be issued a ticket to get inside the port. Once the ticket is given, the driver then enters the queuing area when the check-in personal opens the gate using manual switch and CCTV footage. The parking area before loading is quite large and enough for the ships that depart from here. SO Tallink sees no immediate problem at this port

3. No, the City of Riga did not give any mandate to vacate the existing parking place as its exclusive to only Tallink ships.

4. The question is not applicable for this port.

5. Not required in the case of this port.

6. Yes, as long as the technologies are invested by tallink silja and maintained by the company. The city has no interest in investing anymore funds at the port as everything is working traditionally and well.

7. In the case of Riga passenger terminal, it would be Individual check-in system as the port area is for the exclusive use of Tallink ships.

8. There are no other systems other than loading of the cargo into the ship manually by ground force (stewards) in co-ordination CLO (Chief loading officer)

9. LNG bunkering facilities are currently not available, but there is enough space to implement it when there is a need.

4.3 Solutions

After careful and thorough desk research and taking different opinions of the stake holders. Two solutions are being proposed for efficient and faster check-in of cargo at Helsinki West Harbour. The solutions can also later be implemented at other ports depending on regulatory and stake holders approval.

The first solution is Tallink's already adapted Smart Port technology which is standardised by GS1, this solution is already in use in Tallinn port in trial phase and in Stockholm port with collaboration with other stake holders.

The second solution is a live case study of Port of Liverpool where they were able to achieve semi-autonomous port check-in and system operation using an integration of two technologies namely Navis N4 and ITS e premier module 9 at auto gates.

Apart from the above solutions, there are also some more additional developmental suggestions which can be used to improve and integrate these suggested solutions and create a more efficient and smoother check-in process in the future.

4.3.1 Smart Port Technology by GS1 standardisation.

The first proposed solution is Tallink's already in use Smart Port Technology in collaboration with GS1. GS1 is a not for profit organisation that is responsible for developing and maintaining standardisation and communication throughout the business world. The companies technologies are used in multiple sectors such as retail, healthcare, transport and logistics to name a few. The best example of the GS1 standardisation technology used everywhere is the barcode system. It is the global standard for any product or consumer good making it easier for companies to process, track and store. The barcode not only helps with knowing the price of a product but also traceability such as origin, date of manufacture, place of manufacturing to name a few. So any product that is launched in collaboration with this company has wide range of applications and can be adopted anywhere with ease. Adaptability of such standardization offers minimum errors in the port procedures, better communication, easy cargo handling and proper standard for processing logistics. There are also certain challenges associated with this system such as critical mass and governance. Nonetheless this technology is very effective logistic chain continuity and adaptability which saves cost and time (Kuijpers, 2016).

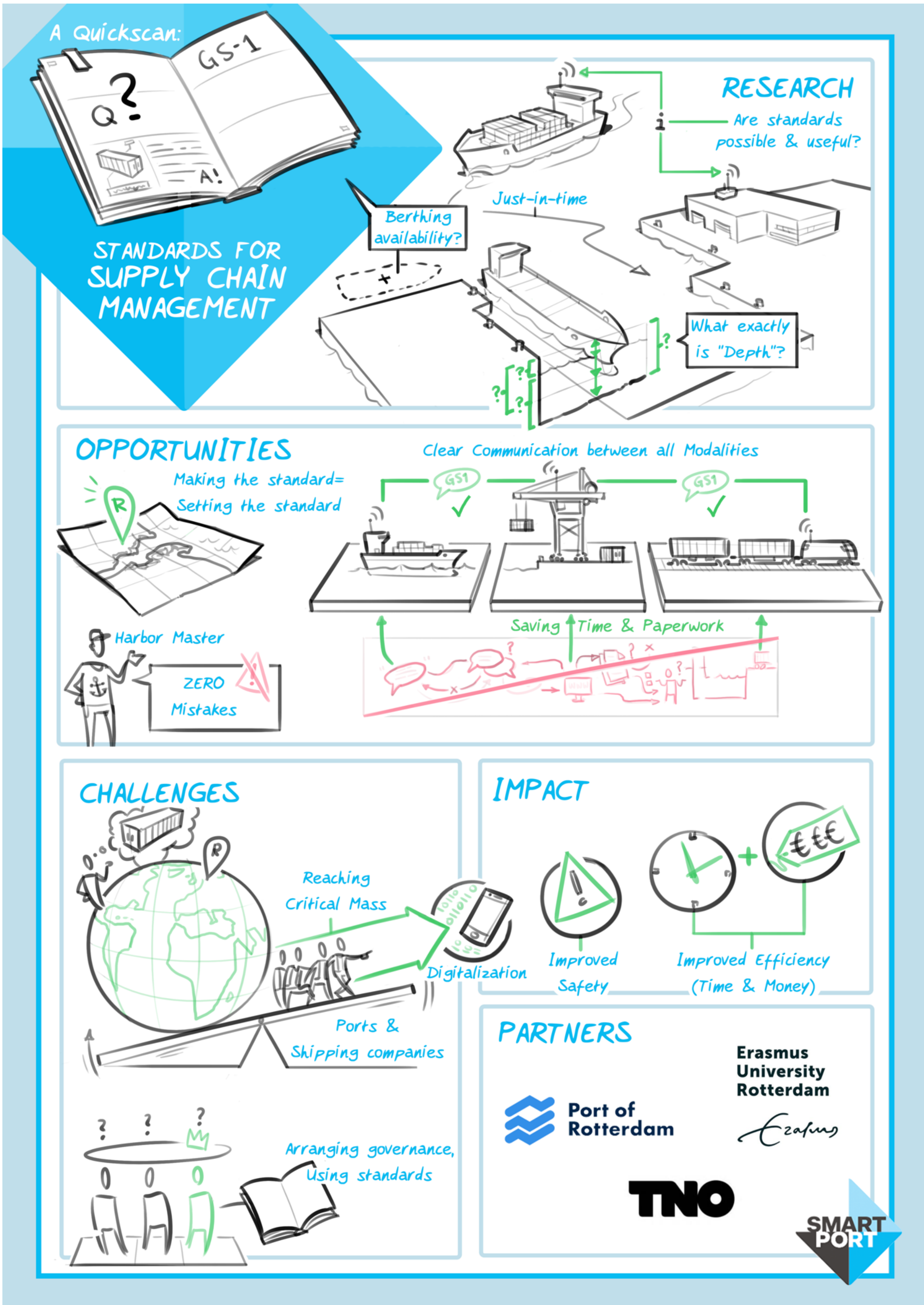
The Smart port technology is standardised check-in system defined by GS1 and mutually collaborated by different ports authorities in the Baltic sea along with Tallink Silja. For example, in the Port of Tallin Terminal D, this technology was funded by the company and implemented as a trial run which gave very good results. Another place where the standardised GS1 Smart port technology which is currently in use is in Stockholm, although there are also other stake holders collaborating in it such as Oriongo for the check-in procedures. The proposed solution is easier to adopt in Helsinki west harbour because of the tried and tested nature in other ports by Tallink and the specified easier adaptability with long lanes of check-in and queuing.

The Implementation of this technology in the port is achieved through the following process. The Port of Helsinki will be responsible for setting up guidelines and standardization procedures in collaboration with GS1 and the company will adapt that into its check-in procedures. There will be a nodal access which will be given to Tallink to share the information with the Port of Helsinki for check-in of cargo and passenger car check-in inside the port. The system is integrated such that when the reservation is made for a departure, the system sends a message to the port's standardised system that there is a specific cargo consignment coming for a specific departure with the details of the driver and cargo, so that all necessary booking information is readily updated in the port system.

Once the truck comes to check-in a pre recognition point the sensors take all the metrics that have already been filled by the cargo booking company and cross reference it if they are correct or not. Once this done and if every metrics seems to be in order the driver is asked to scan his ID at the check-in computer which is placed at almost the height of the window of the driver. In the case that the metrics differ from initially booked information, the check-in system asks the driver to confirm the same and the changed information will be recorded.

In essence, this is a self check-in technology for cargo and car passenger traffic which is cross referenced by sensors to create smooth and uniform check-in process. The driver needs to just confirm all the metrics that are checked by the sensors and then the system guides the vehicle into a queuing lane dedicated to the classification of the vehicle. During the Interview with Janne Kotesmaa (2021), there were also certain suggestions raised which should be addressed such as extending the check-in system to mobile phones via app or mobile webpage to create convenience to the driver. Baltic ports during winter season get to very cold temperatures which makes the touch response system of the self check-in computers very unresponsive and also creating bottlenecks during the check-in time (Kotesmaa, J. 07 Jun 2021).

Below is an illustrative image provided by the smart port technologies on how the technology was designed and implemented in the port. What were the metrics and inputs that were taken in order to achieve maximum efficiency (Kuijpers, 2016).


A Quickscan:
GS-1
Q?
A!
STANDARDS FOR SUPPLY CHAIN MANAGEMENT
RESEARCH
Are standards possible & useful?
Just-in-time
Berthing availability?
What exactly is "Depth"?
OPPORTUNITIES
Making the standard= Setting the standard
Clear Communication between all Modalities
GS1
GS1
Saving Time & Paperwork
Harbor Master
ZERO Mistakes
CHALLENGES
Reaching Critical Mass
Digitalization
Ports & Shipping companies
Arranging governance, Using standards
IMPACT
Improved Safety
Improved Efficiency (Time & Money)
€€€
PARTNERS
Port of Rotterdam
Erasmus University Rotterdam
TNO
SMART PORT

4.3.2 Navis N4 system combined with Auto Gate technology.

Another similar check-in solution that is proposed is to use an automated and intelligent gate check in system provided by two different companies, which is a combination of Navis N4 system terminal operating system (TOS) combined with ITS e premier module 9 and Auto Gate technology for measuring of metrics to achieve maximum automation leaving less work for the driver at the check in gate and thus some of the information that is needed for the check-in at the moment will be automatically detected by the automated intelligent gate system.

The check-in process is achieved through the following. The cargo customers are divided into two groups using the existing two lanes in the port to check in. The primary or the first one being pre checked-in cargo trucks where the companies or the driver before his/her arrival would automatically fill in all the information during booking the cargo shipment and the driver would come to the digital check in station to only fill the mandatory information missing and confirm his identity. The second lane would be ideal for small and medium sized companies who did not do the pre check in beforehand and they can confirm all the details there which would be cross checked by metric machines.

A prime example of implementation of this technology is seen at the Port of Liverpool when the operators of the port 'Peel Ports' have turned the port into Europe's first semi-automated container terminal. Following the building and commissioning of, the Navis N4 Terminal Operating System (TOS) and AutoGates which are live and fully operational. This is part of company's 300 million redevelopment project to improve and create Liverpool 2.0, reinforcing its position as the UK's largest transatlantic deep-sea port and container terminal. This platform for information systems, which has been undertaken by extensive testing and implementation, has achieved a streamlined process from landside or quayside entry till the exit with faster and efficient turnaround times.

To manage gate operations, the completely automated AutoGate system employs cutting-edge identification technology, ensuring that all containers and trucks are automatically recognized before entering or leaving the terminal. Peel Ports' existing terminal operating software, Navis N4, and Customer Access Portal are easily integrated with advanced OCR and line-scan camera technologies (CAP) which is part of ITS e premier module 9 systems. It further authenticates the driver/load identification and improve the security. The security procedure is finally completed with biometric fingerprint identification.

The installation of AutoGates and the new Navis N4 TOS, according to David Huck, Port Director, "is a very important step for us in making a difference to our clients, boosting their experience utilising the port". They took a very risky step of combining both projects into a single project in order to minimise any disturbance to their clients' procedures of operation and provide the technological advantage sooner. Despite the additional risks associated with this decision, The company was able to provide a big boost in their capacities thanks to months of planning and hard effort by the entire team. (NAVIS N4 Terminal Operating System and Intelligent Autogates Open At Port Of Liverpool, 2015).

The operators were happy to see that the transactions of hauliers are now fully linked into the N4 system, resulting in a more secure and efficient visits at the terminals and a shorter turnaround times. This approach also eliminated the need for excessive paperwork and passengers need to exit their cars, enhancing security, boosting safety, lowering hazards, and saving time spent performing manual checks and check-in's. the AutoGate equipment is supplied and installed by Kalmar and its partners, APS Technology Group. The APS Technology Group was responsible for providing the OCR (Optical Character Recognition) technology. These automated gate check-in solutions promote increased efficiency, resulting in lower overall operational costs, improved safety, and better equipment availability. The Process automation solutions are also intended to improve the flow of information within the terminal's business operations, resulting in the most efficient equipment use.

"Landside collaboration is the single biggest remaining opportunity to reduce inefficiency," said Andy Barrons, Senior Vice-President and Chief Marketing Officer of Navis. He also further elaborated that "Peel Ports is tackling this head-on with the implementation of new technologies and processes that will help to move the hauliers through the terminal more quickly. Navis is pleased to be partnering with N4 on these initiatives, and we look forward to working with Peel Ports as they expand the usage of these technologies at Liverpool2 and other ports within the company."

The haulier records their lorry consignment details on a simple and streamlined online system before arriving on site. The device will scan a lorry as it enters the port, automatically gathering all details (container number, container size type, hazard placards, bolt seals, and container damage) by optical character recognition. It will also scan the driver's licence plate and capture a picture of him. The driver visits a kiosk, scans their biometric ID card (which is linked to the online account used to register the shipment), and answers a few questions on a touch screen monitor. When the driver enters the terminal, the system directs him and informs the Straddle Carrier that unloading/loading will occur. (NAVIS N4 Terminal Operating System and Intelligent Autogates Open At Port Of Liverpool 2015).

4.3.3 Additional development suggestions

Along with the two suggested solutions, In this thesis I also wanted to suggest some additional developments which can be implemented in near future which are complimentary to the suggested technologies.

As an added initiative I would like to suggest an integrated UI (user interface) mobile application which can be logged in using Tallink Grupps own 'Club One' Loyalty programme or physical cards used by the drivers that can be used to store their identification details (like passport, driving license etc.) and can be used for check-in instead of scanning their identification documents every time they have to do a self check-in.

In future they can also implement a hybrid mix model of the mobile application based check-in which is integrated to Tallink Grupp's booking system with pre-filled metrics. Once the truck arrives to the port and confirmed by GPS systems of the cargo unit or the app, the mobile application automatically fills the details and cross checks it from the sensors and checks-in the cargo from the mobile application.

4.3.4 Challenges

After looking at solutions and additional developmental suggestions. We should also factor in the challenges to implementations of the solutions. As with any procedural adaptions anywhere there are multiple regulatory and statutory compliances that need to be full filled in our case too. To understand this better I took an interview with Sakari Montonen (2020) from the Port of Helsinki on 08 September 2020 in an online interview.

Montonen, S. (2020) explained that Port of Helsinki were very aware of the problem in west harbour and they were actively looking for solutions that can help easing the bottleneck congestion during rush hours of departures and arrivals of Tallink Shuttles. As Tallink is responsible for transporting highest number of cargo units from West Harbour the need for solutions was imminent.

They investigated technologies like Just in time piloted by City of Helsinki and other port technologies which have been proposed or successfully implemented at other ports. The challenges faced by Port of Helsinki in regards to adapting a new check-in technologies as mentioned by Montonen, S. (2020) is very minimal, this is due to the fact the port (west harbour) is very new and was built in such a way that it can adapt multiple check-in technologies. The port of Helsinki had this idea of multiple stake holder usage while planning and constructing the West Harbour. So it mainly comes down to what the operator company feels comfortable and easy to adapt with.

5 DISCUSSION

Now the solutions have been given, I move onto discussion part where I summarise the whole thesis in connection to literature review before presenting the conclusion. This thesis was a direct demand response of Tallink Silja, a shipping company which is part of Tallink Grupp A.S. Which is a leading European ferry company with operations in many Baltic cities (Tallink Grupp 2017: 57). But main need of the thesis was to suggest a solution to the problem faced by the company at Helsinki's west terminal or the west harbour and this gave me a chance to further develop a solution into a thesis. As the thesis has real-life implication for the company Tallink Silja this made it even a worthwhile thesis for me and marked a very good end to my M.Sc. in international business and entrepreneurship.

So, I started off with discussing what is sustainability in logistics. The main reason for this being it is the perception or the way how a modern consumer coming from 21st century sees a brand is very important metric for companies and many companies are also realising how consumers are becoming conscious every day and the choices they make having a direct impact on companies turnover and image

Then I moved on to talking about what are the barriers involved in developing a sustainable transport and why this is important. There were many barriers in achieving a sustainable transport methods such as rising congestions, incompatibility in infrastructure, growing auto emissions, changes in the way of mobility of how the transport is used etc. this actually helps in understanding why the sustainability is transport quite often well discussed topic and the complexities in implementing the solutions delivered in the thesis.

Next, I moved on to what are the European regulations that actually impact the company in adapting these kinds of sustainable changes or sustainable check-in method. I did see that by analysing what 2050 EU wants to achieve to become sustainable in its outputs and emissions (Jiang et al, 2014: 23-26). This also has an impact on what Tallink Silja wants to adapt and achieve. Then I talked about the new technologies that are slowly coming up in the transport sector and this is very important due the impact they can have on directly reducing and achieving the goals the company set out.

Later, I moved on to the explaining the role of digitalization, this is very important because of the fact that the check-in methods or check-in solutions are totally digital technologies and it's move towards the digital world needs to be very understanding of what digitalization can achieve in terms of efficiency and that's when I also started discussing and how it can change the strategy or the perception of the brand (Bharadwaj et al., 2013).

I also touched the topic digitalization in transport sector because this has a direct impact pertaining to how Tallink Silja vision and adaption can be affected in real life. I saw how the demand response of transport can be managed and how different solutions were suggested based off that. This is a very important aspect in the search for solutions that were given to Tallink Grupp. I later also talked about the digitalization in maritime and port sector. This was done to demonstrate that we were narrowing down the search. I started with the role of digitalization and then went on to explain digitalization in transport sector and finally moved to maritime and port sector. This was crucial in giving us an insight of how the technologies can make an impact on real life and real situations especially in port areas.

In the literature review the final topic I covered is on rapid urbanization because the main reason why the parking area was taken away at the Helsinki west harbour was due to the rapid shift in urban landscape and to analyse the impact it has on other sectors (Cox et al., 2018). Otherwise, the existing parking area at the west harbour would have been a perfectly adequate for traffic management and the check-in could have been done in a very nice way but as the migratory patterns of people move towards cities, every little inch of that city has been rezoned or reshaped into something that can be used by the citizens for creating living or working spaces. I was able to show different views such as the macro view of urbanisation and how it actually impacted the waterscapes and what it did to different cities in different countries and how much impact it really played on the sustenance of the urban areas.

Later I discussed on how the urbanization is done and evolved in the cities bordering the Baltic coast and what was very peculiar to these Baltic areas is that I can see all the capital cities of this regions countries are directly connected with sea. Sea was seen as the main source of where and how the culture shift came and the commerce starting point. Since the main path way to anything that is coming into these countries was through the sea route, this gave rise to the understanding of how the capital cities of all the major Baltic countries are located by the sea side and how these cities are using maritime sector in the present and future as a main transport mechanism (Palmowski & Tarkowski, 2018: 100).

Now that the literature review is completed, I moved on to analysing the company I was doing my thesis for, Tallink Grupp AS. Tallink Silja was a merger of two companies, one namely Silja line based out of Finland and other is Tallink line based out of Estonia. On 12th June of 2006 the Estonian company, Tallink line bought the Finland based Silja Line for 470 million and this marked the syndication of Silja line and Tallink becoming Tallink Grupp AS and some of the ships operating under the company name Tallink Silja line (Dumell 2008:139).

I moved on to the next part and discussed what kind of activities and services the group was involved in. The group predominant line of business is cruise and shuttle services, Cruises are something which are taken by the passengers with longer time spans and leisurely manner whereas shuttle services are pure business or intercity transport between two maritime cities that can be connected as quickly and efficiently by the service.

Their second main line of business and a major source of their income would be the on-board services since they serve the Baltic and Scandinavian coast countries and since these countries are known for very high taxation on products such as tobacco and alcohol. The company offers a solution where many customers use these cruises as a way to buy these things in a cheaper way. This has led to a huge boost in their duty-free sales and travel revenues.

Tallink Grupp was effectively able to take advantage of the no taxation strategy on international waters and offer the right products at a cheaper price for right target groups. This is shown every year in their companies financial statements on how much money the group actually makes. They also hold the title of the largest travel retail outlet company in the Baltics, which says a lot about how much they expanded their reach in terms of on-board services, duty free sales and travel revenues.

Finally, I touched upon their club one loyalty program as this is an integral part of Tallink Grupp's operations as a whole. They currently have more than 2.5 million enrolled customers as their members and it keeps on growing every year. This is one of the largest loyalty programs in terms of numbers in the Scandinavian and Baltic Europe. They have enabled this to get a very good leverage into their travel revenues and also offer better city breaks by using their own products and making sure that customer get more out of their services for better price. Tallink Grupp AS as a brand has gone through various evolutions and has always played a very significant role in terms of transport between different Baltic cities. It has added values to the countries it serves in, in terms of commerce, trade and leisure travel (Malmberg 2007: 8-9; Tallink Grupp 2018).

I later moved on to dwell into the problem at hand because till now, I only looked at a brief idea of what the problem is and in this part I deeply analysed and really discussed about what the problem was. The problem was mainly seen at west harbour of Helsinki port. The harbour had a parking space where the trucks came, stopped, went to the check-in office, to fill their forms and then went inside the port. The place where this west harbour is located is also very significant to Helsinki cities development.

The City of Helsinki is rezoned the parking space into residential and commercial area serving the urban needs of the city and also in turn creating a revenue stream for them. This gave them a need to radically change their check-in methods and efficiently increase their port operations because now they don't have space or time for the awaiting traffic there. They need to quicky check-in the cargo and trucks and get it into the ships and send out to the next port. So, along with this problem and researching for suggestion of solutions, what I also thought to do with my thesis was to check other ports which are part of Tallink Grupp operations and see where these solutions can be implemented or even taken from.

I personally went to interview every port that they were operating out of and had some investigative questions answered which really helped us to standardized different metrics and make it a qualitative thesis with multiple case study focus.

I started off with Turku harbour based in Finland, which is a very manually operated port in terms of cargo check in. Everything in the port there is manual because they have a huge parking space and a dedicated terminal for their operations. They did not see an immediate need to implement or add new check-in solutions. It is understandable because many companies operate on the fact that if it's not needed, there is no reason to invest in new technologies.

I next went to Stockholm which is a brand-new port and had technological embedded systems and also had a parking spaces available for waiting traffic. So, the truck came at the parking area and then check-in at their own convenience. I also observed that they had efficient systems in place and this really helped understand other ports lack of efficiencies. Since there are also other shipping operators sharing the port, they needed to efficiently get things going for it to be a good operational port. This port was also very advanced in terms of technology.

Then I went to Riga which is the capital of Latvia. Since the port is only exclusively used by Tallink Grupp and they had no immediate problem what so ever because there mostly two ships going to this port at any given point and since it is a huge port with enough parking space. It meant that they did not need any immediate solutions. This port can also be classified as manually operated port.

The next port I went to is Tallin, which is their base of operation for Tallink Grupp. Tallink Grupp comes from Estonia. This meant that they have their very own terminal which is very big in terms of size and operations as compared to other ports. They had no inherent problem of parking area or parking check-in but they did want to efficiently change their check-in systems. This also meant that they can increase their operations and put more schedules in the roaster and create a better revenue for the shareholders. They were really intent on building a better and efficient harbour. While I was there, they were experimenting their own technology called the smart port technology which had pre-determined sensors which took measurements of whatever metrics that was needed to be given by the driver already when drove past their sensors. Driver just had to scan his ID and just had to tick certain things on the screen window and then he can readily check-in and go to queuing place before boarding. There were digital boards guiding the driver which lane to park in.

This was something which was very interesting to see and understand, Furthermore also gave me some ideas of what I can suggest for this Helsinki operations. During this time, I also asked various questions which formed a very good pathway to understand different ports of operations.

So, I classified these five ports into three different categories.

The First category are the ports that requires inherent need technology in which Helsinki Port falls into. West harbour of this port is a new port of operation and has technologies embedded for adaptability but not pre-set in such a way to do a faster check-in. it was more on the port infrastructure and passenger movement and other things.

The Second category is those ports that have technology built-in and are ready for operations, Stockholm and Tallinn comes under these because they already have existing technologies and it's all about finding ways towards implementation and making it efficient. Although they don't inherently have the need but they come equipped with technologies.

Final category is traditional check-in ports which are Turku and Riga where the check-in is done very traditionally. Even in near future they don't see a problem but if they do, they can adopt these technologies very efficiently and quickly.

Finally, after taking the interviews and visiting the ports I was able to come to an understanding of how the operations were done and able to give two technologies which can be implemented by Helsinki terminal and also other ports in the future.

The first one being the smart port technology which is standardized by GS1. GS1 is a business standardization not for profit organization. They help in creating standardised rules for different companies operating in the same sector. It was already being implemented in Tallinn port. Reason for its recommendation in Helsinki port was because West harbour is ready to implement it as Tallink already has experience with this technology and have the initial problems and bugs worked out. It's all about interfacing it in such a way that is embedded into the port of Helsinki. I have been able to give some solid examples of how it can be done in our solutions.

Second solution was Navis n4 combined with Auto Gate technology. It takes all metrics which is something similar what is being used in Tallinn port. The sensors are able to measure the length and weight of the truck and watch inside for any dangerous goods at predetermined point using sensors. This system is similar to gs1 but is owned and operated by Navis.
These two solutions were proposed and are very easy to implement and have versatile adaptability into other different ports subject to the approval of the port authority.

Apart from this I was also able to give some additional suggestions such as where the user interfaces can be integrated using or utilising their club one loyalty system where the driver can login and all he has to do is with the touch of button he can check-in already. The other solution was also to implement a gps system of trucks which would give information to Tallink company already, so that the truck that has arrived into the harbour automatically gets checked-in.

After giving these solutions, I also took interview with the Port of Helsinki management, namely with Sakari Montonen (2021), because every solution given would come with its own challenges and have various regulatory implementational issues. The interviewed person said that adapting new technology is not a huge problem. The ministry of transport and port of Helsinki are actually eager to implement solution for the discussed problem as its creating bottle neck traffic jams in Jätkäsääri area. In essence, the implementation of the solutions is not very problematic or objected.

6 CONCLUSIONS

In the end I would like to conclude this thesis by describing my journey in detail and summarizing the whole thesis. The thesis started off as a participation in a talent competition called as Intelligence Hunt 2 for a case company in which we were selected as a group of four students to present solutions. Company we were doing our presentation was for Tallink Silj which is part of Tallink Grupp AS and the case of the competition was exactly what is the foundation for my thesis. The topic was how can Tallink Silja come up with effective check-in solutions that can be implemented in the Helsinki West Harbour. After doing participating in the competition and doing the study and presenting our solutions, it felt very good to give real life solutions with practical implementations that can make real impact in the world and let the companies achieve their goal towards sustainability. This made me take up this thesis and dwell deeper into the topic.

I initially had a discussion with Marina Hasselblatt from Tallink Silja. The thesis topic was accepted after a while, since being a thesis supervisor is time consuming. Once the thesis topic was accepted and thesis supervisor was established, the company gave me access to the company operations to complete my thesis. Then we planned to do an extensive research on different ports of how Tallink Grupp operates in order to suggest the solutions from a macro or wider perspective.

Although it is the Helsinki port that readily needs the solutions right now. We planned together with marina such a way that I go to every port to understand the operational efficiencies and lags. Our plan started from going first to Turku, then to Stockholm, then Riga, then Tallinn and finally stop in Helsinki. At each port I saw how operations grasp them clearly and deeply analysed how the solutions can be suggested.

I prepared an investigative set of questions which was approved by my thesis supervisor at Tallink Silja. Then I interviewed the personnel assigned to me at each of these ports to create a consistent methodology of output which can be later used for solutions. Using this I was able to suggest our solutions which were the smart port technology standardized by GS1 and Navis n4 with ITS e premiere 9 technology line. So, these two solutions can become a real-life implementable solutions to Tallink Silja's problems in Helsinki's west harbour.

The adaptability just not did stop at the west harbour, it is also good for Helsinki Olympia terminal and Riga and Turku. This profound impact on what it can deliver in terms of sustainability and numbers, is what motivated me to do this thesis and go around to understand various port operations. How they can be classified into different technological use they have been in. I hope this thesis would able to give a good solution to Tallink Silja and make an impact on check in methods and implementation of it which they are in eminent need of.

In the end I would like to Thank Tallink Silja, Marina Hasselblatt and also my thesis supervisor Juha Kansikas for giving me this opportunity. Tallink Silja which is part of Tallink Grupp AS is a leading ferry operator in Baltic Sea. So any kind of solution that this company can adapt has major impact in real life due to the sheer volume of cargo that they transport and ports they operate in. This qualitative multiple case study thesis gave me a very profound understanding of practical problems faced by companies and how the solutions can be suggested to overcome them.

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