



UNIVERSITY OF GOTHENBURG
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Analysis of forest industry exports with RoRo ships - Port of Gothenburg

GM0560 V18 Master Degree Project in Logistics and Transport Management

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Abstract

The forestry industry play a significant role for Swedish exports, where the sector produce a large variety of products, including paper, pulp and sawn timber. By nature of the products, the industry export large physical volumes of low value goods, adding increasing demands on transport providers. Thus, with high price sensitivity in forestry logistics, most of the products on export are transported by sea, due to favorable economies of scale. For European markets, short-sea shipping (SSS) provides a low cost mode for goods owners to ship products to the UK or to the continent. However, with increased focus on door-to-door transport, other modes of transport such as road and train are also utilized. While providing economies of scale and being a high frequency mode of transport, RoRo short-sea operators located in Port of Gothenburg are striving to become a vital component within intra-European forestry logistics chains. The challenges are many; including integration with other transport modes and infrastructure, forestry producers own logistic systems, and filling the future higher capacity of newer generations of RoRo vessels with transport volumes. Therefore, this case study aim to explore how the RoRo companies can position themselves within this competitive and changing environment. By conducting multiple in-depth interviews with PoG RoRo operators and shippers from the forestry industry, combined with an investigation into relevant theory, important empirical framework could be developed and analyzed. In essence, by identifying important strategies to enhance door-to-door integration, the aim of this paper is to contribute to the discussion on how RoRo short-sea operators can successfully integrate with intra-European forestry logistics chains.

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Terminology

Bulk Carrier is a merchant ship specially designed to transport unpacked bulk cargo, such as timber, grains, cement, coal or iron ore (Stopford, 1997).

Cassette is a an open-ended steel platform with a cargo capacity of around 60 tonne. Cassettes are loaded horizontally by special trucks called translifters, (Liftec, 2018).

Containerization refers to a system of intermodal freight transport also called maritime containers or ISO container (Lumsden, 2007).

Cross-docking of forestry products in PoG refers to the following: When products have been received they are unloaded, sorted and loaded into load carriers, bound for sea transport (Port of Gothenburg, 2018).

EDI, stands for Electronic Data Interchange.

Intermodal transportation refers to the movement of goods in one and the same loading unit or road vehicle, which uses two or more successive modes of transportation without handling the goods themselves in changing modes (UN/ECE, 2001).

Load carrier refers to the unit containing the shipped goods. This could be a ISO container, trailer, cassette or mafi unit (Lumsden, 2007).

Mafi unit is a roll-trailer for RoRo vessel operators to transport cargo such as containers and project goods, e.g., large equipment and over-sized vehicles. (Equip-right, 2009).

Modal choice refers to the choice of transportation buyers or shippers have when sourcing transport (Vierth et al., 2012).

Multimodal transport is also known as combined transport is the transportation of goods under a single contract but performed with at least two different means of transport (Shipit, 2018).

RoRo, refers to Roll-on/roll-off and is a description of a ship in which cargo is worked horizontally on wheeled vehicles via a ramp and through doors in the vessel's wall (Stopford, 1997).

Shipper is the person/entity that ship cargo from one destination to another (Stopford, 1997). In this thesis the shipper is defined as the person/entity which contracts the RoRo operator to perform a transport service, meaning that the shipper can be a cargo owner or a service logistics

provider, the latter acting on behalf of the cargo owner.

Short-Sea Shipping (SSS) is the movement of cargo and passengers by sea between ports which do not involve an ocean crossing. Short-sea shipping includes domestic and international maritime transport, including feeder services, along the coast and to and from the islands, rivers and lakes (EC, 1999).

Short-Sea Operator (SSO), is the person/entity that retains commercial control of the ship and takes the commercial risks and benefits of its operation in short sea shipping (Stopford, 1997).

SECU or Stora Enso Cargo Unit is a type of intermodal container built to transport bulk such as paper on railway or ships which can carry 80 tonnes. It looks like a standard 40 foot ISO container but it is bigger with dimensions measuring, 13.8 x 3.6 x 3.6 meter (Miljönytta, 2009).

Tonne-kilometres, (tkm), is a unit of measure of freight transportation which represents the transport of one tonne of goods (Eurostat, 2018).

PoG stands for Port of Gothenburg.

Table of contents

Chapter 1 – Introduction	1
1.1 Background	1
1.2 Current challenges	2
1.3 Problem description	3
1.4 Purpose and research questions	3
1.6 Delimitations	4
Chapter 2 - Literature Review	6
2.1 European freight transport	6
2.1.2 Intermodal and multimodal transportation	7
2.1.3 European short-sea shipping and RoRo shipping	8
2.1.4 SECA Rules and EU environmental maritime policy	10
2.1.5 RoRo short-sea shipping in multimodal freight transport	11
2.1.6 Competitiveness of RoRo short-sea shipping in multimodal freight transport	12
2.1.7 Logistics strategy for SSS operators in multimodal transport chains	13
2.2 Transport modal choice	15
2.3 Swedish Forest Industry	16
2.3.1 Swedish forestry industry logistics	18
2.4 Summary of literature review	19
Chapter 3 – Methodology	21
3.1 Research Design	21
3.2 Research approach - Inductive reasoning	21
3.2 Literature Review	22
3.3 Data Collection	22
3.3.2 Case studies and qualitative interviews	23
3.4 Research quality	23
3.4.1 Validity	23
3.4.2 Reliability	24
Chapter 4 – Results	26
4.1 The case study	26
4.1.1 The companies participating in the study	26
4.2 Factors influencing modal choice of forestry products	27
4.2.1 Market trends and logistical needs of the forestry industry	27
4.2.2 Factors influencing modal choice for transport buyers of forestry products:	31
4.3 Strengths and weaknesses of RoRo operators in PoG	34
4.3.1 RoRo operators	35
4.3.2 Shippers	36
4.4 Strategies and service level of Short-sea RoRo operators	37

4.4.1 RoRo operators	37
4.4.2 Shippers	38
4.5 Summary of key findings	39
Chapter 5 - Analysis and discussion	43
5.1 Competitiveness short-sea shipping in multimodal freight transport.....	43
5.2 Logistics strategy for SSS operators in multimodal transport chains	44
5.3 RoRo in PoG: Transport modal choice	45
5.4 SWOT analysis.....	46
5.4.1 Strengths	46
5.4.2 Weaknesses.....	47
5.4.3 Opportunities	48
5.4.4 Threats	49
Chapter 6 – Conclusion.....	52
6.1 Research questions	52
6.2 Suggestions and Recommendations for RoRo operators in PoG.....	54
6.3 Future research	55
References.....	57
Appendices.....	62

List of figures

<i>Figure 1 EU 28 Short-Sea Shipping by sea region, in 2015</i>	<i>9</i>
<i>Figure 2 EU 28 Short-Sea Shipping by cargo in 2015</i>	<i>9</i>
<i>Figure 3 Marpol Annex VI timeline for limitation on sulfur content in marine fuels.....</i>	<i>10</i>
<i>Figure 4 A RoRo-ship</i>	<i>11</i>
<i>Figure 5 Illustrating paper rolls</i>	<i>17</i>
<i>Figure 6 Illustration of paper pulp</i>	<i>17</i>
<i>Figure 7 Illustration of sawn timber.....</i>	<i>17</i>
<i>Figure 8 Mode of transport – Exports of paper and pulp & Sawn wood in 2015.....</i>	<i>18</i>

List of tables

Table 1 SWOT Analysis for RoRo shipping operators in PoG	50
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Chapter 1 – Introduction

This first chapter introduces the research topic and the background factors which forms the foundation of this master's thesis. Then a problem description is introduced, followed by an explanation of purpose of the study along with the research questions. Finally the delimitations are presented.

1.1 Background

Since the 17th century, Sweden has been a major exporter of raw materials including forestry products. Even with today's modern consumption patterns, the forestry sector is still a major contributor to economical growth (Mckinsey, 2018). In terms of physical aspects and transport volumes, the contribution is even larger. Thus, when evaluating impact of forestry products such as paper, pulp and sawn timber on the logistics industry, other product areas seem rather insignificant in comparison (Skogsindustrierna, 2018). Since most of the products are bound for exports, for a majority of the products, maritime transports is being used. Therefore, within intra-European trade flows, short-sea shipping transport companies such as RoRo shipping operators in PoG, have long developed their networks, infrastructure and operations around these major trade flows (Port of Gothenburg, 2018). Moreover, in contrast to iron ore, oil, chemicals and other important bulk categories, many forestry products have been subject to a gradual process of *unitization*, where goods can be carried in standardized loading units (Port of Gothenburg, 2018). This process has arguably spurred a growth in the amount of load carriers used in today's logistic systems. In effect, a continuous optimization of modal choice has become necessary, both from a shipper perspective but also from a policy perspective. This optimization is in line with the EU's aim to shift transport volumes from road to maritime transport. One such example, under the TEN-T framework, is the *motorways of the seas* program introduced in 2001 (EC, 2018). The aim is to address congested intra-European land corridors by adopting a meaningful shift away from road to multimodal transport. More specifically, the objective is to promote door-to-door transport chains, involving at least two ports, a short-sea leg with high a frequency service, in liaison with train where applicable (Douet and Cappuccilli, 2011). Under the above framework, transport operators are relying on important physical flows of forestry products, and are in essence both competing and collaborating at the same time. For RoRo shipping operators in PoG, emphasis on making core operations more efficient is imperative, but in a door-to-door perspective, other aspects should arguably be focused on as well. Therefore, activities steered towards expanding networks, where strategic partnerships and collaborations with other actors and stakeholders are formed, should become highly relevant.

1.2 Current challenges

For the actors involved in operations in the PoG, the challenges are many, including infrastructure planning by the port authority, to improve port functions and connectivity. Other challenges for PoG and RoRo operators, aiming to gain more volumes from the important forestry sector include, adapting capacity to an increased unitization within transport systems (Port of Gothenburg, 2018). By logic, if the shippers decide to transport forestry products in unitized load carriers instead of in bulk, it could increase the likelihood of goods being routed via PoG and RoRo shipping. However, for the majority of forestry products on export within Europe, the larger forestry companies have developed in-house logistic systems, where mainly sea-going bulk carriers or RoRo vessels are operated by the owners capacity (Skogsindustrierna, 2018). In addition, the large volume producers have also developed their own tailored load carriers to further take advantage of economies of scale. Accordingly, Stora Enso uses a system called SECU for transporting paper, which in contrast to traditional ISO containers can carry four times its volume (Miljönytta, 2009). From a shipper perspective, it makes sense to increase loading capacity which leads to higher efficiency throughout the transport chains. However, it can also leave the shipper vulnerable to downshifts in demand as well as lost flexibility. After all, owning and operating seagoing vessels can be a risky undertaking, where supply and demand cycles can be notoriously punishing (Stopford, 2009). With high capital investments of owning, operating and maintaining sea-going vessels, shippers are likely weighing their options on a periodical basis in the transport market. The RoRo companies themselves are not immune to the cycles of shipping, where often times an over-capacity is the result of too many actors adding to their new-build portfolio at the same time. As a result, some of the upcoming new generations of RoRo vessels, are being constructed with a 50% higher loading capacity (Port of Gothenburg, 2018).

Within this context, long term changes in the way the large Swedish forestry companies will conduct their future logistics seem rather difficult to predict. As a consequence, for RoRo operators in PoG, positioning and planning for future capacity becomes strategically important activities. At the same time operators need to stay focused on current demands and adapt to short term fluctuations in logistic flows of forestry products. With sporadic and unpredictable changes in shipping routes, from both larger and smaller forestry shippers, PoG RoRo operators would likely benefit by expanding intelligence on the mechanisms driving motivations for transport modal choice and on integration strategies within door-to-door transport chains. In this thesis, special emphasis will therefore be placed on how to increase integration into forestry logistic chains for of RoRo operators in PoG.

1.3 Problem description

In a competitive environment with shifting supply chains for forestry products, PoG RoRo operators must find ways to ensure that they are well positioned to attract and being able to handle both current and future goods volumes. Forestry products by nature generates large physical flows of goods, and therefore a special focus on this industry segment becomes key. Amongst the important factors to consider, increasing RoRo capacity, expanding networks and the integration of door-to-door transport chains becomes highly applicable. Therefore, this paper looks into how RoRo companies in PoG can enhance their understanding of the logistical needs of the forestry industry while assessing strengths and weaknesses towards this segment. More specifically, by comparing literature on modal choice, SSS competitiveness and strategy within multimodal transport chains, to the empirical findings of a case study, a framework of practices can be developed to assist RoRo operators going forward.

1.4 Purpose and research questions.

The purpose of the study is to investigate what RoRo short-sea operators in PoG can do to successfully integrate with intra-European multimodal transport chains of forestry products. By providing the above background and problem description, a main research question has been developed. By answering the following sub-questions covering the areas, within which the study is concerned, it will be possible to answer the main research question and thus fulfill the aim of the study.

How can RoRo short-sea shipping operators in Port of Gothenburg improve their integration into multimodal forestry logistics chains?

- 1. How do the current and future logistical needs of Swedish Forestry companies influence their transport mode choice?*
- 2. What are the strengths and weaknesses of RoRo shipping operations in PoG associated with their integration into multimodal forestry logistic chains?*
- 3. What commercial and operational strategies can RoRo Short-Sea Operators in PoG follow in order to increase volumes of forestry products shipped via RoRo shipping?*

1.6 Delimitations

Due to the relatively short time frame to conduct research for this study, the scope is delimited according to below mentioned areas. The main focus of the study lies on how RoRo ship operators in PoG can gain more volumes of forestry products. Although, the port is a co beneficiary of any positive outcomes, the study will mainly take the perspective of the RoRo ship operators throughout the thesis. Additionally, the study also brings in the perspective of shippers or goods owners for a further understanding on the topics covered, as well as perspectives from the branch organization of the Swedish forest industry. Although a large part of Swedish exports of forestry products are transported outside of Europe, this study only concerns intra-European exports. Similarly, although the majority of sea transports to third country destinations, outside of Europe are mainly conducted via container vessels, there are likely some volumes transported via SSS within Europe. However, this thesis will not include any investigation into any seagoing transportation of forestry products using containers, internationally or within Europe. Furthermore, the focus throughout the thesis is on RoRo short-sea shipping and not on other types of SSS.

The *ship operators* referred to in this study, are in the main business of selling maritime transport services. The ownership structure of shipping companies can be rather complicated where there are various degrees of operational involvement from an owners perspective. For instance there are owners who solely provide *tonnage* on the charter market to companies who are then operating the vessels, as well as ship owners who also handle their own commercial and/or technical operations (Stopford, 2009). However, the distinguishing nature of ownership structure is of no relevance to the scope and therefore, this study will refer the RoRo companies involved as *RoRo ship operators*. Furthermore, the owners of cargo, i.e. the forestry companies are mainly referred to as *shippers*. Other intermediaries and transport service providers such as *freight forwarders* and *cargo handlers* are included in the scope, but only service aspects involving the connection to forestry transport chains via RoRo short-sea shipping is relevant to the study.

Although there is a shifting variance on how different forestry products are being transported, depending on factors such as origin, destination and physical nature of the forestry products, the study will not aim to discuss certain transport flows of specific products, but rather a general stance towards intra-European forestry product exports from Sweden will be held. Furthermore, the outcome of modal choice is surely subject to various types of cost/benefit analysis, where comparisons between shippers own logistics systems and the outsourcing of transportation by using logistics services of many actors can be made. However, due to the perceived complex nature of such interrelationships, no such analysis be included in this study.

Chapter 2 - Literature Review

The aim of the theoretical framework is to provide theory on which the empirical results as well as the analysis are based. In support of the case study analysis, the review will provide a solid and conceptual framework of reference. The scope of the section includes important aspects involving the area of European freight transport, with an emphasis on short-sea shipping and RoRo operations. Moreover, it covers theory on intermodal or multimodal logistics chains with a clear focus on forestry industry logistics networks. Finally, important theory on logistics strategy and the competitiveness of short-sea shipping around the integration of multimodal logistics chains and its intermediaries, is included.

2.1 European freight transport

Freight transportation involves the ability to move goods quickly, safely and cost effectively between markets and is a crucial element in international trade. For the purposes of integrating an enlarged EU (EU, 28), where advantages of economics of scale help to consolidate production in fewer locations, together with just-in-time supply principles, demands on freight transport across the EU are expanding. However, strains on infrastructure causing congestion and delays, as well as interoperability often accompanied with governance issues, may prove to hinder developments within the EU transport sector in the future (Eurostat, 2017).

Within EU-28 and in terms of modal split amongst five transport modes in 2015, road keeps a leading position. Accounting for about half of all tonne-kilometres (tkm) performed intra-EU, road is followed by maritime transport which closely accounts for one third of the total performance. Rail and inland waterways account for 12.3% and 4.3% respectively. In terms of transporting goods within the EU, air transport only plays a marginal role, with a share of 0.1%. The statistics are pre-dated by growing performance numbers between 2010-2015 of 1.8% overall, where air and rail showed significant growth of 10.7% and 6.1% respectively. A growth in performance could also be determined in the maritime segment where the amount of tonne-kilometres grew by 2.9% (Eurostat, 2017). Due to congestion and increased external costs such as environmental impact, the EU has long strived to promote a modal shift from road to other modes of transportation. Especially applicable to this case study, one such program, labeled as “Motorways of the seas”, promotes the use of short-sea shipping to be included in door-to-door transportation chains within Europe (EC, 2018). In effect, such policies also promote the integration of different modes of transportation where the concept of inter-modality or, multimodal transportation chains are created. With the forestry industry being especially volume-intensive in transportation chains, actors such as RoRo operators can play an important role in this integration.

2.1.2 Intermodal and multimodal transportation

In order to coordinate sustainable transportation networks to combat environmental effects and congestion from road transportation, policy makers are today busy with the optimization of transport modes. Within this context, *Intermodal transport* use several forms of transportation where efficiencies and cost advantages of each mode are leading to a reduction in both internal and external costs (Ahlberg, 2016). On EU level, by definition and according to a joint document by the European Commission, European Transport Ministers and the United Economics Commission, it can be defined as follows:

“The movement of goods in one and the same loading unit or vehicle which uses successively two or more modes of transport, without handling the goods themselves in changing modes” (UN/ECE, 2001).

In recent decades the use and development of intermodal transport in the EU has been high on the policy agenda. This is mainly due to the roadmap of reducing emissions by 60% from the levels in 1990, before 2050. Thus, in a white paper from 2011, medium distance freight journeys were deemed to shift by 50% from road to rail and waterborne transport (European Commission, 2016). The term is often used in the same context as *Multimodal transport*, which refers to the use of more than one mode in a transportation chain (e.g. semi-trailer truck and RoRo shipping), but in contrast to Intermodal transport, the goods can be handled in between the transport modes (Bergquist and Monios, 2016). However, nowadays the two terms are often used interchangeably, and therefore for the purpose of this report, where forestry products are rarely transported in the same loading unit throughout the transport chain, the term multimodal transportation will be used.

While road transport offers high accessibility, in order to maintain economy and limit environmental impacts, it is especially suitable for high value goods, with smaller shipments over short distances. Although flexible in nature, bad timing and limited growth possibilities due to increased congestion can mean longer transport times. Conversely, for rail and sea transport a substantial transport market for high value goods is limited. Moreover, the high fixed terminal costs and low variable haulage costs, make rail and sea transport especially suitable for large scale transports of heavy goods, such as forestry products, over long distances. As a consequence, the logical step is to promote a combination of different transport modes in order to take advantage of economies of scale, maintain flexibility, while decreasing external effects (Bergqvist and Esping, 2002). The European short-sea shipping segment, primarily serviced by RoRo shipping can offer such a combination, and has a large potential to contribute to a sustainable development of multimodal supply chains.

2.1.3 European short-sea shipping and RoRo shipping

As outlined previously and according to scholars Paixao and Marlow (2002), the shift from road to sea in freight transportation has long been considered one of the major objectives of the EU. Thus in order to ensure that European supply chains with the expected future growth rates are sustainable, a common transportation policy of promoting door-to-door transport services where a sea-leg is introduced has been high on the agenda. By definition, short-sea shipping can be quite complex due to the many varieties of shipping segments, with different types of ships involved. In an attempt to define the types of vessels involved in SSS, Paixao and Marlow (2002) identify four categories of ships which are outlined as follows; The first category is single-deck bulk carriers, employed on a voyage basis and many times used to carry forestry products or other minor-bulk categories. The second category is container feeder vessels often operating in the Mediterranean sea, the English channel, the Baltic sea and the Atlantic coast. The third category which is included in the segment subject to this report, are the ferries which includes RoRo. Due to its horizontal loading capacity it is often seen as an extension of road or rail transport. As explained below, RoRo vessels can carry a variety of horizontally loaded cargoes but also passengers. The RoRo traffic operating in the Baltic sea is a clear example of this segment . The fourth category refers to the fleet of smaller bulk carriers and tankers engaged in conventional dry and liquid bulks (Paixao and Marlow, 2002).

Out of the total maritime transport of goods to and from the main EU ports in 2015, short-sea shipping represented 59% of volumes. The predominance of short-sea over deep-sea shipping within Europe can partially be explained by geographical considerations. Countries with an especially high rate of short-sea shipping include Sweden, Norway, Denmark, Finland, Greece and Malta, amongst others (EC, 2018). In the case of Sweden and its Scandinavian neighbors, they all have long coast lines where a substantial part of import and exports are transported by sea. Thus in Sweden, up to 85% of the handling of goods across borders is carried out in ports (Lumsden and Sthyre, 2003-2005). In addition, large volumes of feeder services also play a role in countries functioning as regional transshipment points. Amongst European regions, the North-sea and the Mediterranean are the largest areas of short-sea shipping with 26% and 29% respectively in 2015. On third, the Baltic area comprised of 22% (see fig 1).

European Short Sea Shipping by region

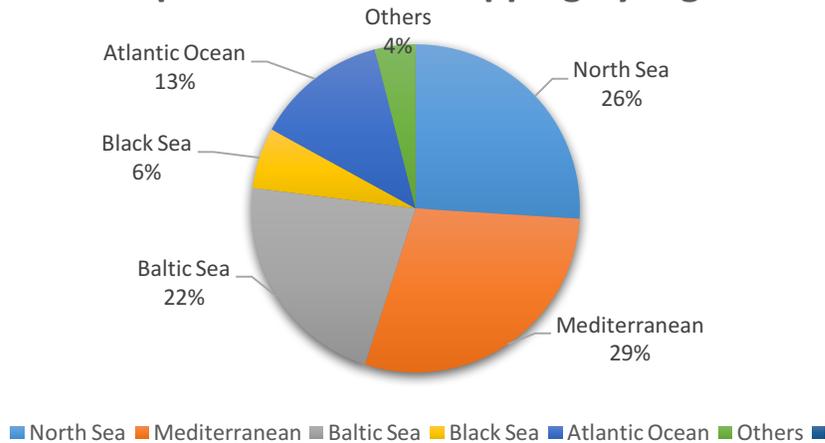


Figure 1 EU 28 Short-Sea Shipping by sea region, in 2015 (in % of total gross weight of transported goods (EC, 2018).

In terms of short-sea shipping by type of cargo (see fig 2), Liquid bulk is the dominant cargo in Europe. As fig X shows, it accounted for 45% of the total shipped goods in 2015, to and from main EU ports, followed by Dry bulk which accounted for 20%. RoRo shipping only accounted for 14%, followed by container shipping at 20%. The time period in between 2006 and 2015 contains an important trend within European short-sea shipping, where transports of Liquid bulk decreased (from 49.5% to 45%), whereas RoRo and Container transports increased (from 12.8% to 14% and 10.5% to 15% consecutively). Dry bulk has seemed to stay at a stable level during the same time period (EC, 2018).

European Short Sea Shipping by Cargo

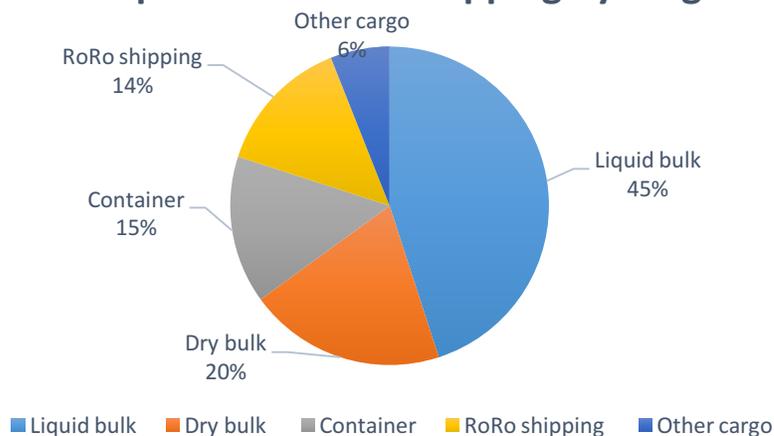


Figure 2 EU 28 Short-Sea Shipping by cargo in 2015 (in % of total gross weight of transported goods (EC, 2018).

Despite a seemingly small share of short-sea maritime transport within Europe as a whole, in the Scandinavian transport networks, RoRo shipping plays a highly important role and can be seen as a prerequisite for moving cargo between land and sea in efficient multimodal transport chains (Lumsden and Styhre, 2003-2005). Furthermore, since maritime transport performs very well environmentally, RoRo shipping plays an important role in the sustainable future of European transports. Together with other short-sea operators in Northern Europe, the mode has been on the forefront of adopting rigid emission standards, which will be explored in the following section.

2.1.4 SECA Rules and EU environmental maritime policy

In 1997, the International Maritime Organization (IMO) first adopted the Annex VI of the International Convention for the prevention of Pollution from Ships (MARPOL). The objective was to reduce the air polluting substances contained in exhaust gas of maritime vessels. More specifically, the focus was mainly on limiting harmful substances to the environment and human health, such as sulphur oxides (SO_x), nitrous oxides (NO_x), ozone depleting substances (ODS), as well as emissions of volatile organic compounds (VOC). Then in 2005, a revised MARPOL Annex VI came into force which strengthened the restrictions while gradually reducing the allowed emissions. It was under the revised Annex VI, that emission Control Areas (ECAs) were created, and stricter limitations on sulphur emissions were implemented (IMO, 2017). Figure 3 below illustrates sulphur caps both globally and in (S)ECAs. The stricter emission caps meant that already in 2015, the sulphur content in marine fuels was reduced to 0.1% in the SECAs. Furthermore, the objective of Annex VI is reaching a global sulphur cap of 0.5% by 2020.

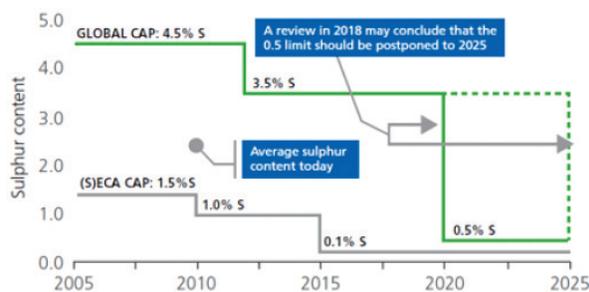


Figure 3 Marpol Annex VI timeline for limitation on sulfur content in marine fuels. Source: DNV.

The European Union (EU) is in the forefront when it comes to environmental regulations. In terms of emissions from the shipping sector, the EU support a global approach led by IMO. Such an approach is believed to be the most effective given the international nature of maritime transportation (European Commission, 2017). Despite active support from the IMO, the EU has issued further legislations. As an example, the 2011 White Paper on transportation issued by the European Commission, include a target to cut in shipping emissions by at least 40% in the EU by 2050 (European Commission, 2018). Forming environmental policy for SSS is one thing, but in door-to-door multimodal transport chains it is also important that each mode of transport is

utilized to its fullest potential. As such, the next section explores how RoRo performs in the context of transport inter-modality.

2.1.5 RoRo short-sea shipping in multimodal freight transport

To transfer goods horizontally between different modes of transportation is the most efficient way to load or unload goods on ships (Lumsden, 2007). These vessels, illustrated by figure 4 below, are by definition called roll-on/roll-off (RoRo), and can essentially transport all kinds of goods that have first been loaded or transshipped to load carriers, including Semi-trailers, Cassettes or Mafi. The great loading efficiency is an advantage where set departures and arrivals are often stressed to reduce harbor time. Since a roll-on/roll-off vessel is designed to carry wheeled cargo, goods can swiftly be driven on and off the ship using a built in ramp. The transport method is especially suitable for accompanied lorries crossing waters in the North and Baltic Sea Region. Other loading units such as containers are also suitable to be transported via RoRo, as they can be placed on cassettes before being wheeled into the vessel during loading and then handled by tractors for transshipment at the unloading point (Bergquist and Monios, 2016). However, the horizontal handling can also lead to unutilized capacity which is signified by the chosen unit of measure, *lane meters* in RoRo shipping. Ultimately, the space in between between decks cannot be completely filled and utilized (Lumsden, 2007) unless the RoRo vessel is built with adjustable decks.

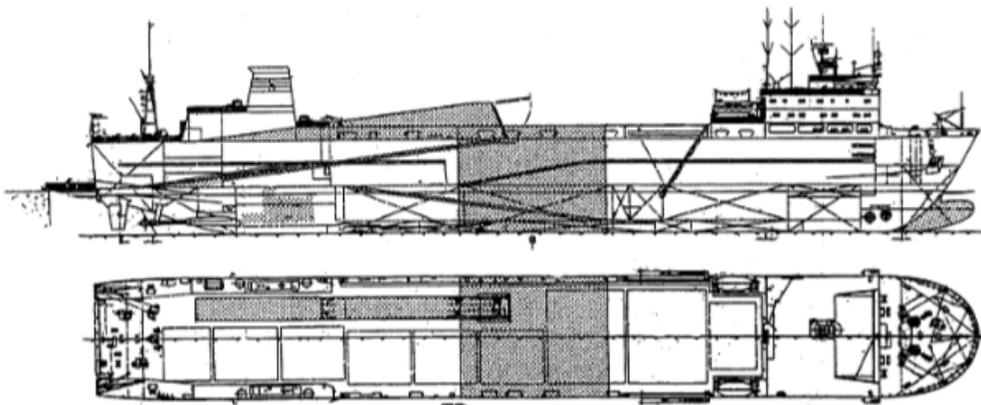


Figure 4 A RoRo-ship (Lumsden, 2007) A RoRo-ship (Lumsden, 2007).

Despite RoRo short-sea shipping's potential of becoming a successful component and facilitator in shifting intra-European transports from road to sea, the development of short-sea shipping within the EU was long lagging behind (Eurostat, 2003). However today, with the high priorities on the EU agenda, the SSS sector and RoRo operations have improved (EC, 2018). As Casaca and Marlow (2005) explain in their exploration into the competitiveness of SSS, successful integration into multimodal chains depends on SSO abilities to adapt to logistical trends and the demands set upon them from changing supply chains. As such, the next section will provide

insight into the underlying factors that may facilitate such developments, as well as the service attributes that are needed for progression within SSS.

2.1.6 Competitiveness of RoRo short-sea shipping in multimodal freight transport

In order to understand the challenges of SSO's to fully integrate with intra-European door-to-door transport chains, Casaka and Marlow (2005), identify significant supply chain trends in Europe during the last decades. The first major trend involves the outsourcing of non value activities, such as logistics, warehousing and transports in global supply chains. While outsourcing these logistical activities, multinational companies can focus on core business areas and strengths, but they can also become more flexible and adaptive in their response to agile markets. One of the effects has been an increased centralization of warehousing through the development of information systems, which includes integration of both upstream actor and downstream actors in the supply chain (Simchi-Levi et al, 1999). According to the research of Fernie (1992), this has led to more strategic partnerships, and other alliances. With increased transparency and more efficient supply chains, just-in-time delivering strategies have been implemented by global companies. However, in contrast to just-in-time strategies in the US or in Japan, where the focus has been on integrating regions, in Europe, such developments have mainly been made on a local level. Thus on a pan-European level there has been a reluctance to adopt to this greater efficiency due to the difficulties of making information systems manageable in several currencies or languages. Therefore, difficulties in tracking, tracing and sharing information has left European logistics providers, such as SSO's with the option of only offering shore-to-shore solutions rather than controlling the cargo flows within the whole transportation chain (Casaka and Marlow, 2005).

Given the above trends and changes in demands of global supply chains, companies will continue searching for ways to improve customer added value and competitive advantages by developing fully integrated supply chains. In order to become market leaders, they will focus on time-based strategies, where responsiveness, flexibility and agility will form a basis in effective supply chains (Cooper, 1993; La Londe and Masters 1994; Lambert, 1992). As a consequence, transport operators such as RoRo companies, will need to develop matching capabilities in order to respond to the ever increasing challenges. Indeed RoRo shipping is just one way of many choices that goods owners and transport buyers have when they source for the best possible logistics providers within their supply chains. Therefore unless SSO's will be able to increase their knowledge about what the client really need, want and value, there is a risk of a continuous reliance on road transportation within supply chains.

Accordingly, in a study by Casaka and Marlow (2005), service attributes needed for SSO's to successfully integrate into in multimodal logistics chains were identified, ranked and summarized as follows:

1. Carriers' logistics network design and speed
2. Cost of service (Freight rates) compared to quality and reliability
3. Carriers representatives sales and after sales behavior
4. Investment policy
5. Corporate image
6. Commercial/operational and carrier-shipper's relationship policies
7. Involvement in the forwarding industry
8. Service guarantee

The authors have found that most stories of success in short-sea shipping focuses on increased frequency of service rather than on value added services. However, relationship management towards existing and potential clients, such as the cargo owners themselves is extremely important (Casaka and Marlow, 2005). Although research show that SSO's are usually not in direct contact with the goods owners themselves, but rather using freight forwarders. As a consequence, these intermediaries now become the main point of customer contact. The lack of communication with their true customers poses a threat for the SSO's, since intermediaries such as a freight forwarder can design logistics chains in such ways that ports and short-sea shipping is not involved (Casaka and Marlow, 2005). To shed insight on the matter, the next chapter explores the elements of logistical strategies which SSO's can use to improve or create the needed value adding service attributes to gain control over supply chains.

2.1.7 Logistics strategy for SSS operators in multimodal transport chains

As covered in prior sections, SSS including RoRo as a transport mode, has been long seen and promoted by the EU as a more environmentally sustainable alternative to road transport. This along with potential alleviation effects on congested intra-European trade routes. However, in order to be effective and to make full use of its potential, SSS needs to be able to offer door-to-door transport services, with a seamless integration of different transport modes. Such a set up requires the development of extensive and strategically important best logistics practices (Coyle et al, 1992), in order to achieve excellence. Thus, in a case study conducted by Casaka and Marlow (2009), after surveying a population of SSS companies, a sequence of eight defined logistics/supply chain strategies were identified. By order of importance they are listed as follows:

Adopting a total quality-management strategy; The concept of total quality-management or TQM can be described as management tool or system that focuses on a customer-oriented organization, while involving all employees in continual improvement. In essence, it uses strategic data and effective communications to infuse a discipline of quality into the culture and activities of an organization, ultimately to improve performance (Jacobs and Lummus, 2014).

Adopting an integrative strategy: In order to develop a seamless integration of different transport

modes, a network approach needs to be in place, where infrastructure, transport operators and facilities are connected. Thus, collaborative attitudes between the SSO and its customer becomes important as well as diversity measures, where local representatives are servicing the local markets. Other measures can include investments in logistics operations or other value added activities, other than transport related operations (Paixao and Marlow, 2009).

Adopting a freight-forwarding strategy: As freight forwarders are experts in logistics networks, they are the contracting party to carriers, often using multiple modes of transport to move goods (Bergquist and Monios, 2016). They are also influencers of the transport modes where the goods are conveyed. In this sense, SSO's should consider freight-forwarding as a core part of the operators' activities. Furthermore, the strength of adapting a freight forwarding strategy, is the ability to gather information about the actual needs and market preferences of the shippers or the users of SSS services. Thus, a tailored service can be constructed were the use of uni-modal transports such as using only road, can be discouraged (Paixao and Marlow, 2009).

A partnership strategy: Due to market pressures and limited company size, SSO's often find themselves having difficulties achieving economies of scale and to successfully integrate into multimodal transport chains. Therefore, the forming of strategic alliances is often key in order to survive in an increasingly competitive SSS market. Thus, with access to a broader market, more flexible services along with cost reductions can be offered by enforcing this strategy. Examples of partnership strategies for a SSO can include a position within a port network, where by using the facilities and services of the port, both physical and informational flows can favorably be utilized (Paixao and Marlow, 2009).

An inland clearance depots strategy along with a terminal strategy, can help to control cargo flow along the transportation network nodes or within a trade corridor. Thus by streamlining clearance procedures, a higher service level and differentiation can be achieved (Paixao and Marlow, 2009). The concept of dry ports has been well documented by logistics scholars as they offer an array of services and advantages such as customs, clearance, transshipment services, or storage facilities, which are all necessary activities when connecting international door-to door transportation networks (Bergqvist and Monios, 2016; Bergqvist and Woxenius, 2011).

An outsourcing strategy; As the name implies, an outsourcing strategy involves strategic alliances with different actors in the transportation network, without infusing too much capital in the form of a vertical integration. Instead, third party actors such as inland clearance terminals or port operators as well as information system providers can be utilized, depending on the strategic value or level of control the SSO wishes to maintain (Paixao and Marlow, 2009).

A time-management strategy; A crucial part of the service attributes that SSO's operator are offering, is the possibility to track a customer's cargo throughout the transportation chain. Thus multimodal transport services which includes a sea leg, such as RoRo, must be able to offer transparency for optimal service level. Therefore, well implemented information systems are

crucial elements in order for SSO's to maintain timely transports (Paixao and Marlow, 2009).

In essence, the goal of these strategies is to integrate the several actors in transport chains, in order to facilitate tracking and tracing of cargoes along the transportation chain. Hence, they offer improved visibility, collaboration and coordination of activities which reinforces the role of the SSO as an integrator of supply chains. In other words, large focus lies on creating comprehensive networks with transport chains that are controlled by the SSO, where the different strategic partners such as ports, train operators and transshipment depots collaborate to achieve economies of scale and improved customer service (Paixao and Marlow, 2009). A fundamental factor in becoming an integrator of networks and supply chains, lies in the understanding of the needs and wants of the goods owners. Therefore, in the next section, a review of how transports are purchased as well as the criteria's that goods owners consider when forming the basis of modal choice is covered.

2.2 Transport modal choice

There are many ways available for goods owners to handle transportations. Often times they own and operate seagoing vessels, or form partnerships with local transport companies who handle all transports for the owner. Other common ways include the outsourcing of transports as well as the planning of transport to third party logistics providers. However, in Sweden most commonly an individual transport contractor is being used (Laitila & Westin, 2000; Lammgård, 2007; Mellin and Vierth, 2009).

The question of modal choice is a transport buyers decision regarding which mode of transportation will be chosen for certain goods. The most fundamental factor to take into consideration is the distance the freighted goods will travel, as well as inherited differences between national and international freight transports. Moreover, there are qualitative factors such as *flexibility, frequency, reliability, on-time, speed* and *security* which are often compared to the *price* of the transport (Vierth et al. 2012). The importance of the different criteria vary depending on the perspective of the transport buyer, as well as industry specific demands and company size. Another crucial factor when choosing mode of transport is the nature of the goods itself and to what extent shipping parcels can be unitized (Ahlberg, 2016). For instance, while some forestry products such as paper, pulp, and sawn timber are able to be shipped in containers, semi-trailer or cassettes, other commodities such as oil or iron ore are generally shipped in bulk. In recent decades, the question of modal choice has also taken sustainability factors into consideration, such as consciously aiming to limit the amount of road transport used. (EC, 2018).

In a fundamental study of the Swedish transport industry, conducted by Vierth et al (2012), the following conclusion could be made regarding the area of modal choice: Although, transport

quality is high on the agenda for buyers, together with the many circumstantial factors, such as geography and industry, the most important factor is still price. The second criteria is reliability, such as the avoidance of damaging goods. Thereafter, the time of transportation is valued, followed by sustainability. As mentioned, different industries have different priorities, where the value of the good in comparison to its physical volume becomes important determinants. To a large extent, the cost of transport is less important for high value goods, while goods owners of low value goods often scrutinize transport cost carefully (Vierth et al, 2012). Perhaps the most sensitive industry when it comes to cost of transportation, is the forestry industry. Hence, the next section will look into this market as well as the logistical aspects involved.

2.3 Swedish Forest Industry

The forestry industry in Sweden is one of the most important sectors for employment. With over 70k people employed and an additional 30k private employers, the industry serves a key role for economical growth in the country. Over 70% of Sweden is covered by slow growing forest where 80% is used or grown by industry. The industry adheres to a sustainable model where only 1% is used yearly. Thus in 90 years, the available forest has doubled. As a producer of renewable bioenergy the forestry industry also contribute to a sustainable society where 15% of Sweden's total energy output is from renewable sources. Moreover, the forest industry is a highly export driven market and since the goods are mainly domestically produced, it contributes to a important share of Sweden's trade balance. Sweden is the 3rd largest exporter of forestry products in the world, and with 80% on export, the total value amounted to 125 Billion Swedish Kronor in 2015. Out of the volumes generated in 2015, 17,8 million cubic meters of sawn timber, 10.1 million tonne of paper and 15,5 million ton pulp was produced. With around 50 paper and pulp producers, 120 saw mills and 40 peripheral companies, the industry also constitutes as the largest buyer of transport, generating 25 Billion Swedish kronor yearly (Skogsindustrierna, 2015). The industry is a large net exporter of different forestry products and only a relatively small amount is imported. The largest commodity exported is paper products (see fig. 5) were after a declining demands in last decades for printed paper, packaging materials has taken over as the primary growth product in this segment. In the EU, Germany and the UK are the largest buyers of paper products were 1.9M tonne and 1.1M tonne were transported in 2015. Large volumes of sawn wood products (see fig. 7) are also exported for use in the construction industry amongst other areas. The exports in this segment are steadily growing with a significant amount transported to the UK. About 2.7M ton of sawn wood products were shipped to the UK in 2015, and only about half that amount (1.4M tonne) were shipped to the second largest export country, Egypt. As in the case for paper products, Germany is the largest buyer of paper pulp where according to the latest trade statistics, about 0.7M tonne were shipped in 2014. Wood pulp (see fig. 6) can be used for many different applications including chemical manufacturing and as recycled materials (Skogsindustrierna, 2015).



Figure 5 Illustrating paper rolls (Kraftpaper, 2018).



Figure 6 Illustration of paper pulp (Qdport, 2018).



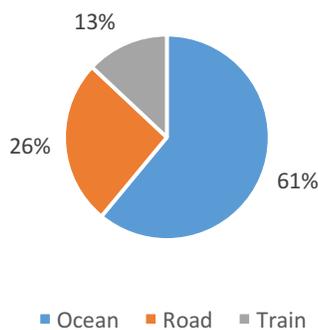
Figure 7 Illustration of sawn timber (App Timber, 2013).

2.3.1 Swedish forestry industry logistics

The forestry industry is one of Sweden's largest transport buyers. After being harvested from forests around Sweden for processing, the ready product; paper, pulp and sawn timber can be transported around the world. Therefore, a well developed infrastructure with established transportation chains is crucial in order for Sweden to maintain its position as one of worlds largest exporter of forestry products (Skogsindustrierna, 2018).

Due to economies of scale, and relatively low environmental impact within multimodal transport chains, rail is extensively utilized for transports of some forestry products within Sweden. The trains are primarily used for paper and pulp and it is a mode that the forestry industry is aiming to grow in the future. However, by far the largest share of forestry products is transported by sea, where the forestry companies own logistic systems are utilized in between harbors in Sweden and the European continent, as well as the UK. As mentioned, the majority of the Swedish exports are transported by sea often using the forestry company's own fleet of bulk vessels. As figure 8 show in 2015, 61% of paper and pulp was exported via ocean transport, while 26% and 13% was exported via road and rail transport respectively. For sawn timber, 42% of export volumes were transported via road which tends to increase as demands for reliability, punctuality and flexibility are more in focus. Train is many times not a viable option for sawn timber due to the dependency of on transshipments which are cost driven. Furthermore, saw mills usually don't have railway tracks installed in their industry locations.

Mode of transport - Exports 2015
Paper and pulp



Mode of transport - Exports
2015 Sawn wood

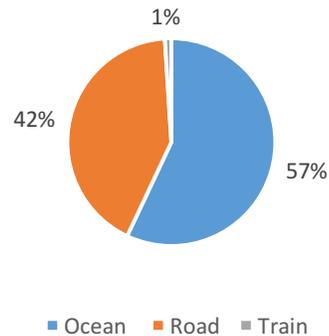


Figure 8 Mode of transport – Exports of paper and pulp & Sawn wood in 2015 (Skogsindustrierna, 2015).

2.4 Summary of literature review

This concludes the theory section where the relevant literature to the study was presented and categorized. The review consisted of three sections, where first, an introduction on European freight transport laid the foundation for literature on intermodal and multimodal transportation, European SSS, SECA rules and EU environmental policy and RoRo short-sea shipping in multimodal freight transport. Also within the first section, highly relevant literature on the competitiveness of SSS in multimodal freight transports as well as logistics strategy for SSO's, in multimodal transport chains was presented. The second section introduced literature on modal choice in Swedish freight transport, with important emphasis on modal choice criteria. Finally, the literature review introduced a breakdown of the Swedish forestry industry as well as forestry industry logistics.

In the next section, methodology of the case study will be presented. As an important remark the above literature review forms the basis of constructing the tools used to collect data, which in this case is through semi-structured interviews. Furthermore by comparing the empirical results in chapter 4, with the above established literature, important patterns and similarities as well irregularities will be analyzed and discussed, which will result in the final conclusions.

Chapter 3 – Methodology

In this section a description on theoretical concepts on methodology will be provided as well as a connection between these concepts and how the study has been conducted. The aim of the methodology is to be able to answer the research questions in accordance to a scientific approach.

3.1 Research Design

Two major paradigms are subject to consideration when conducting research. One is positivism, where social reality is singular and objective, thus being independent to the researcher. The other paradigm is interpretivism, where social reality is considered to be subjective and socially constructed. In other words, social reality is shaped by our perceptions (Collis and Hussey, 2013). There are some major differences in research approaches under the two paradigms. For instance, while positivism uses quantitative data with a scientific aim, interpretivism uses qualitative data, which is data in named form and approaches the studies in a humanist manner. It can also be said that a positivist study produces research that is more conclusive in nature, where the findings are the only solution to a research problem or question. Under interpretivism on the other hand, an exploratory research approach is used, where it is not necessary intended to provide conclusive evidence, but rather to explore the research topic using varied levels of dept. The latter is particularly suitable when trying to gain insight and further understanding of a research topic. It is also especially oriented towards cases where there is a research gap with an undefined problem (Sounders et al, 2012).

In this report, an exploratory approach under the paradigm of interpretivism where qualitative data is used as primary and secondary data has been conducted. Although prior research exists for all subject areas including the competitiveness of short-sea shipping, as well as forestry industry logistics chains, little have been researched regarding the combination of the RoRo shipping and the integration of forestry logistics chains. Therefore, there seem to exist opportunity to explore this area more in detail with the aim to develop new insights regarding the future competitiveness of RoRo shipping in Port of Gothenburg.

3.2 Research approach - Inductive reasoning

While a deductive approach generally used in positivist studies use quantitative data, and generally follows a “top down” method where the focus lies on validating theoretical construct, an inductive approach can be described as a “bottom up” direction approach. Thus observation and theories are developed towards the end of the research process, as a result of observations. In

other words, when following an inductive approach, with a research topic as a base, the researcher develops empirical generalizations by observing the world, in order to identify preliminary relationships during the course of the study (Goddard and Melville, 2004). It is important to note, an inductive research approach does not disregard established preexisting theory when formulating the research question (Sounders et al, 2012). Therefore, as a chosen method for this research study, with an inductive approach, a theoretical framework can be first be established. This in order to learn from experience and to identify important patterns and regularities in the areas of SSS, as well as in forestry industry logistics. More specifically, by conducting a case study, meanings can be generated from the empirical data and when compared to existing theory, important patterns and relationships can be developed into new theory (Sounders et al, 2012).

In other words, this study will use existing case studies and findings within the area of SSS and forestry industry multimodal transport chains, along with other related theory, in order to first identify and establish a research gap, which in this case is RoRo operator integration with multimodal forestry logistics chains. A case study using questions to explore the factors pre-determining such as research gap as well as the factors needed in order to answer the research questions will then be conducted. By comparing the empirical results of the study with established literature, important patterns and similarities as well irregularities will be analyzed in a SWOT format, which will result in final conclusions.

3.2 Literature Review

In order to show what knowledge already exists and to form a context for the research problem, a literature review or theoretical framework is developed. Thus established theory as well as ideas can be related to the problem at hand (Blumberg et al., 2008). Accordingly, the review both identifies the research gap which this study aims to fill, but also provides a foundation with information that can increase the understanding of the research problem as well as for an analysis of the results.

For this study, secondary data was collected from books, journals, articles, statistical data bases, company or EU/Swedish government websites or other internet sources. Special focus has been placed on the selection of reliable sources from researchers in the chosen field.

3.3 Data Collection

The process of data collection can be described as collecting relevant information in order to find answers to a research problem, testing a hypothesis and evaluate outcomes. The collected data can be in either primary or secondary form where the former can be the results from a first

person interview or questionnaire or other survey methods. Secondary data is the type of data already available and published.

3.3.2 Case studies and qualitative interviews

Common in exploratory research, case studies study a phenomenon together with surrounding context. Typically, a case study answers the questions “why” and “how” in relation to the issue or phenomenon, within the boundaries of a specific environment, situation or industry (Blumberg et al., 2008). By conducting interviews in qualitative studies, a high degree of flexibility can be achieved. Thus characterized by the qualitative nature, the result of an interview is subject the personal opinions and perception of the interviewee. The conversation during the interview is often allowed to take different directions and to branch out from the question formula or transcript. Furthermore, there are two main types of qualitative interviews; one is an unstructured type of interview, where only a few guidelines are scripted before conducting the interview session, and the other type is a semi-structured interview. The latter is used in this study where a mixture of open ended questions and closed questions are used in order to optimize the results of the interview (Collis and Hussey, 2013).

The primary method of collecting primary data for this study is through interviews, using semi-structured questions (see appendix 1) conducted face-to-face. With a data population consisting of a number of people representing RoRo shipping operators as well as shippers in the forestry industry, the interviews are scheduled based on availability and the given time frame of the master thesis.

3.4 Research quality

3.4.1 Validity

Validity refers to the extent to which the research findings accurately reflect the research problem or phenomena under the study (Collis and Hussey, 2013). There are two forms of validity to be taken into consideration; One refers to external aspects or how well the results can be used to generalize or how well the results can be generated to other short-sea operators (Blumberg et al, 2008). The external validity in this case is strengthened by including viewpoints from multiple RoRo operators as well as viewpoints from multiple shippers, all with extensive knowledge and experience within the subject industry. The other form, internal validity refers to if the method of collecting primary data is effective enough to generate the relevant data it claims to collect. In this case study this would apply to the interview guidelines and the actual interviews. In general, a higher number of interviews from different actors within the research area actors would likely have increased internal validity. Due to time constrains and human

resource constraints an amount of 10 interviews were conducted. Another aspect of internal validity is the ability to estimate and predict (Blumberg et al, 2008). This is more difficult to measure, but nevertheless in relation to the PoG RoRo and forestry logistics chains, the interviewees represent a large part of this segment and therefore the results should be sufficient in order to estimate the situation. Furthermore, validity can be subject to the underlying theory used as well as the method of collecting data (Blumberg et al, 2008). For the case study a substantial effort was made to build a solid and relevant theoretical framework, adequate to achieving the objective. For this reason, since the interview guidelines reflect the knowledge received from the literature review, validity should be positively affected.

3.4.2 Reliability

Reliability refers to the absence of different outcomes in the results, given that the same study was repeated. In other words, studies with a high amount of reliability need to be able to consistently generate the same results, with the same research method used under similar conditions (Collis and Hussey, 2013). In other words, the results from the method of collecting data should be as consistent as possible in order for the study to be considered reliable. The validity of a study is also dependent on reliability since if the method of collecting data or the measurement tool produces erratic results, no results can be valid. The semi-structured interviews used in the study ensures that the interviews measure the same thing each time and should therefore provide a sound base for ensuring reliability. Furthermore, the same interview guidelines were used throughout the interviews to avoid the risk of jeopardizing reliability. Finally, the interview guidelines are based on extensive studies of literature within the area of research, which should further promote reliability of this study.

Chapter 4 – Results

In this chapter, the results from conducting 8 separate interviews are featured in order to learn about the potential of RoRo shipping operators located in PoG and how they can succeed in becoming a vital part of Swedish forestry logistics chains. More specifically, the aim of the section is to answer the research question “How can RoRo short-sea shipping operators in Port of Gothenburg improve their integration into multimodal forestry logistics chains”. By finalizing the interview results under the three sub categories of the main research question, it will be elaborated on and finally summarized under key findings.

4.1 The case study

Two categories of industry actors were interviewed in order to gain a wholesome perspective into the abilities of RoRo shipping operators in PoG, to integrate with Swedish forestry logistics chains. The two categories are distinctively different by operative and commercial nature, but commonly they all form a crucial function within door-to-door logistics chains of forestry products. First, by interviewing the “RoRo operators” themselves, important insights were received on how they aim to position themselves in an ever changing and competitive market environment. Secondly, the “shippers”, in this case two forestry companies and one road hauler were interviewed in order to gain aspects of their logistical needs and the factors that needs to be taken into consideration when choosing transport modes. Moreover, as representatives between the forestry companies and the government, the forestry industry’s branch organization ‘Skogsindustrierna’ was also included under this category. Due to the mutual benefit of maintaining an anonymous approach when describing the results, the companies will be labeled or denoted companies *R1,2,3,4* for the RoRo operators, and companies *S1,2,3,4* for the shippers.

4.1.1 The companies participating in the study

4.1.1.1 RoRo Operators

Out of the RoRo operators participating in the study, R1 is one of Europe’s largest shipping and logistics companies with several subsidiaries within its network. With its location in PoG and with a large network, the company connects Swedish forestry companies with important RoRo sea links between ports in England and Northern Europe. The second RoRo operator, R2 is involved in worldwide transportation and offer RoRo ferry connections between the United Kingdom, Scandinavia and Continental Europe. Both R1 and R2 owns and operates their own logistics division with a large international transportation network. Company R3 is a port-to-port RoRo operator with connections between Sweden, Finland and continental Europe. Finally, company R4 specializes in Ropax ferry operations, with an extensive network ranging from the

United Kingdom, Scandinavia, continental Europe as well as Eastern Europe and the Baltic sea. The company offers door-to-door transport solutions including train services from the north of Sweden to Southern Europe.

4.1.1.2 Shippers

In reference to the shippers participating in the study, Shipper S1 is not a goods owner who sources transports for its operations, but a branch organization which represents the forestry companies, i.e. shippers in Sweden. Shipper S2 is a major pulp and paper manufacturer who focuses on offering the paper packaging market with sustainable materials and solutions. With headquarters in the Stockholm region, its operations span from the UK, Sweden to Finland. Shipper S3 represents the saw mill perspective in the study as it produces and delivers sawn timber worldwide from its milling operations in mid-northern areas of Sweden. The final shipper S4, is represented by a trucking transport provider who uses the services of the above listed RoRo companies. As an international transport provider with operations in Sweden and throughout Europe, it is heavily focused on the transport of forestry products.

All of the above companies were asked questions related to the three sub categories of research questions and the results are presented accordingly under the following sections.

4.2 Factors influencing modal choice of forestry products

In this section the results related to the sub-category research question “*How do the current and future logistical needs of Swedish Forestry companies influence their transport mode choice?*” is featured. In order to effectively sort and conceptualize the information specific to the question, the results begin with assessing general market trends and transportation related needs of the forestry industry. In this sense, perspectives of both RoRo companies and shippers are included.

4.2.1 Market trends and logistical needs of the forestry industry

As a general rule, the Swedish forestry industry can be perceived as very price conscious and all of the companies participating in the study acknowledge this fact. Primarily, this has to do with the nature of the products shipped, being of low economical value compared to the physical aspects where substantial loading space is required. As one of the companies expressed, ‘This is just the way this section of the freight market is, and there is little that can change this fact’. However, there are some trends that are mentioned that would perhaps begin to alter the old norms of how these products are being transported. Company R1 acknowledges, in what used to be a rather stable market, with exports of paper, pulp and sawn timber, other products have been introduced. For instance, the print paper market has suffered a great deal during the last decades, due to paper being replaced by digital media. While many anticipated the forestry companies to suffer a great deal along with their dependent transportation sector, the opposite has actually

taken place. Since the larger producers have been quick to adjust production to new types of products that will be demanded in the future, no such long trending down term has actually occurred. Today, packaging materials and other sustainable products are being shipped to the same European markets that gradually failed to demand printing paper. However, as company R1 points out, the downturn forced the forestry producers to carefully scrutinize transportation costs and therefore there is now much more transparency.

Company R2 sees efficiency as one of the most important aspects in forestry supply chains. Thus it favors the current awareness of most related stakeholders regarding the importance of building supporting infrastructure within transportation chains. Being a door-to-door transport provider, it sees the lack of sufficient infrastructure as the biggest obstacle to the growth of RoRo operations within forestry transportation chains. The planning and building of a new multimodal terminal next to the RoRo terminal in PoG, serves as an example of a step in the right direction. However, if efficiency at the beginning of the transport chain cannot be complimented at the end, there will always be bottle-necks in the system. Therefore, matching unloading capacity in its European consolidation hub, Zeebrugge in Belgium, is needed in order to absorb more volumes generated by greater efficiency in PoG.

Other needs and trends that can be attributed to the forestry industry, include the increasing focus on safety standards. This is more typical for the larger forestry producers or actors. As one operator explains, the number of transshipments are being taken into consideration since each occurrence could potentially increased risk of damaging the materials. For instance, a dent in a roll of paper could result in damaging ex amount of paper arcs, with large economical losses as a results. Company S1 who is the branch organization for the Swedish forestry industry, sees a steadily growing industry with large current and future investments spurring growth and demand. Some of the positive outlook comes from a growing export market for sawn timber materials and paper pulp mainly to China, where forestry companies such as SCA is steadily increasing overseas shipping volumes to meet increasing demand. In terms of forestry production, sustainability is on the forefront and Sweden is growing more trees than what is currently being used. This at a time when the rest of the world is doing the opposite, i.e. Canada and Russia.

According to shipper S2, the industry's focus on sustainability is also transferrable to the transport industry. According to the demands placed forward, safety comes first and thereafter the promise to the customer. The costs of transports are considered as a third category and sustainability can sometimes even be assessed before costs. Primarily shipper S2 is looking to reduce CO2 levels during transport of their products. The focus on sustainability and environmental aspects is confirmed by shipper S4 who emphasizes the importance for haulers to be certified according to standards such as ISO 9000. To enforce environmental standards, many of the forestry larger companies demand reports on a quarterly basis, CO2 emissions to be included in their reports.

Shipper S3 underscores the fact that it is a low paying industry to provide transport for, while rigid standards of service level are being demanded. The size and location plays a large role, and there is competition from the larger forestry companies such as SCA who produces large volumes. For smaller actors, it is better to cooperate with the large producers in order to gain access to flows of transports. For S3, one way to distinguish itself on the market is to offer flexibility in the way the wood products are cut and produced. However, this in turn causes problems since sometimes the lengths or dimensions are outside the boundaries of load carriers. Furthermore, company S3 believes that railway transports and sea transports are likely to increase due to increasingly higher environmental standards to be upheld by road transports. As an effect, the first thing that will likely take place is a higher use of railway transports. However, these volumes are not necessarily best routed via ports such as PoG and onto RoRo linking ports on the European continent. The main reason is that these ports at the receiving end are currently unable to handle large increases in volumes via RoRo or other feeder services. So in the context of replacing road traffic to European destinations with more volumes through PoG, the infrastructure of the European ports would not be able to support it. Hence, any infrastructure developments would have to be implemented on the continent first. Moreover, on the European continent, railway operations are more and more discontinued and replaced by road. This puts even more pressure on infrastructure in ports to establish effective consolidation and transshipment services.

The forestry industry is increasingly focused on status reporting during transports where shipping information is demanded on a continuously basis. For shipper S4, this is where GPS technology comes in handy to facilitate delivery status towards its customers. As the company explains, if a road hauler and the goods owner have the same GPS system installed, they can synchronize each others systems and allow the goods owner to check for status on the rucks.

4.2.1.1 Forestry companies own logistics systems vs standard transports

For large forestry companies, owning and operating seagoing vessels, volumes have to match the capacity that has been bought. With more cost transparency today compared to 10 years ago, more and more goods owners are aiming to be as flexible as possible. As company R1 explain; today, shipping managers have to present the factual cost per tonne, i.e. outside of using a 100% capacity. Moreover, shippers have to ask themselves if it is their core business to operate ships or should they concentrate on core competence, and instead hire transport services from transportation companies?

All of the companies confirm that the larger forestry producers are mainly using their own logistics channels. This could be in the form of seagoing vessels calling ports from the east coast of Sweden, or via trains either bound for ports such as PoG, or operating south, through Sweden down to the continent. As R1 confirms; any deviation from using these transport chains, are likely due to disruptions in production when extra transport capacity is needed. As explained,

different customers uses PoG's RoRo services in different ways. Most forestry companies are likely customers in one way or the other, but some large producers use the mode only for backup solutions. For example, Holmen paper has their own seagoing transport system from Hallstavik and bråviken. One vessel is going to Germany and the other to the UK, and about 95% of their volumes are transported this way. With fixed costs from hiring the vessels, the capacity is already bought. If they have disruptions and are falling behind in production or if the produced volumes are too high in order to meet the capacity demand, then they use RoRo services in PoG. They can book via another trailer operator and then drive onboard R1's RoRo vessels. Moreover, under these same circumstances, with fast changes in logistical routing, railway is not often used since these shipments requires fast and flexible setups.

Shipper S3 close in location, cooperates with SCA and utilizes its transport systems. This is mainly due to the large volumes and economies of scale being created. The sawmill acknowledges that SCA owns and operates a large fleet of bulk vessels, but also a large fleet of container feeders. These feeder operations are currently not utilized to their fullest capacity because the costs of operating them are too high. Hence, shipper S3 does not see a real benefit of owning ships in the future, especially not ships used to transport sawn timber products which typically offers a low pay load. However, for paper, S3 thinks seagoing vessels may be of benefit also in the future due to higher pay rates.

By contrast, according to S1, the larger companies such as SCA have no problems filling the capacity of their own ships and there is a lot of cooperation between smaller and larger actors to make sure that capacity is filled. On the other hand, PoG has done well absorbing large quantities of transports by train and this system is working very well. If only the ongoing port conflict could be solved, there is great potential for continuous business for RoRo operators in its port. However, in the Northern parts of Sweden, shipper S1 feels that the transport systems in place are well developed and are functioning well. This mainly due to the lack any other economically feasible alternatives. Therefore, it would not be an easy decision to abandon these seagoing logistics operations unless there is anything extra offered, such as better lead times via train, earlier clearance or more effective consolidation points. After all, sea transports offer superior environmental scores, with lowered emissions and congestion effects. In conclusion shipper S1 claims that SCA will not abandon their own developed maritime transport systems and neither will other large producers such as Smurfit Cappa or Holmen paper. Shipper S4 has the same view as S1; The larger producers have worked with these sea transport systems for a very long time, with often large investments involved. It doesn't seem that this model will change in the near future. For these reasons, the only thing a road hauler such S4 can compete on is lead time. So for goods that are urgent, other modes of transports are then considered such as trucks. However, the transition periods between discarding old ships and replacing them with new ones are always interesting periods. This is due to the enormous investments that are needed to build new ships. As an example, S4 mentions the two ships Holmen paper owns which are starting to

come of age. Here lies a perfect example of the uncertainty that can precede shipper's decisions to continue to operate sea going vessels. The shipper continues; If the ships are also running below capacity, it is especially important to come up with alternative solutions to quickly fill capacity or else, the business model will perhaps have to be scrutinized. One such creative solution is to allow trailers from road haulers to drive onboard these ships and thereby cooperate with the goods owners. This could be a good way for the forestry companies to maintain a good economy, and good for the haulers who can save on transportation costs on certain routes. However, this could also mean a competitive situation for PoG and its RoRo operators, since volumes with this setup would not be routed via PoG.

Regarding the future use of tailored load carriers, such as the SECU, developed by Stora Enso, the consensus amongst the RoRo operators in PoG is rather hesitant. The key factor is that the added capacity must outweigh the costs of using them, and there are some constraints to be mentioned. As company R2 and R3 explain, there is no secret of them coming of age, and so far no new units have been added to the market. Furthermore, the added costs of upgrading or repairing them, to keep them operational now after 20 years of use, would seem imminent. Another challenge is to fill the capacity of the SECU's with import goods. Although there has been some success fitting them with personal cars bound for the Swedish market, so far any significant volumes of reverse flow of products have yet to materialize. Although, if phased out of operations, another challenge may arise for the shippers. Due to their high capacity and closed structure, being protected from weather elements, they have successfully been used as storage units at the distribution point. The advantage of this setup has challenged the need for storage facilities, which has likely been economically and logistically favorable for Stora Enso. Conclusively, despite reservations of its continuance, the operators are not anticipating any quick abrupt changes, thus flooding the system with alternative loading carriers.

4.2.2 Factors influencing modal choice for transport buyers of forestry products:

4.2.2.1 RoRo Operators

As mentioned in the theory section, there are both circumstantial factors to take into consideration as well as more general areas when exploring the area of modal choice. As such, there are certain aspects that determine or limit the use of PoG and RoRo, due to the nature of circumstances. The geographical location of the shipper is one such factor, where companies in the mid-south or the southern part of Sweden would have to go to unreasonable lengths in order to route PoG within their chain of transports. Another factor is the nature of the goods being produced, where a saw mill producer's logistics setup differs from that of a paper producer. The size of a company also matters, since with enough volumes, internal logistics chains are often developed with ownership of infrastructure and perhaps a greater emphasis on sustainability of transports is occurring. Nevertheless, these factors are highly applicable to the study and

therefore they are included below along with more classical performance indicators, such as quality, efficiency, frequency of service, security and speed.

When it comes to Geographical aspects, the smaller saw mills in southern Sweden and their transport providers act in rather unpredictable ways when it comes to choosing transportation routes. Firstly, the sawn timber products from this region are almost exclusively transported via road. In addition, many times the mills have no interest in what routes the trucks take as the transports are often outsourced to haulers. As R1 explains; Some drive up to PoG and some drive via Skåne ports. There is a conceptual boarder somewhere between Halmstad and Helsingborg and across the country i.e. shippers located north go via PoG and those located south go via Skåne. So if the RoRo operators in PoG adjust their pricing lower, this geographical boarder is lowered and vice versa. Another geographically related transport mode factor is the balance of the flow of goods. Trailer operators are likely not interested in seeking cargo up to the northern parts of Sweden unless they can secure cargo for the reverse haul. The above dilemma for PoG show the clear relationship between road transports and price level, and could serve as an example as to why forestry transport chains are mainly price driven.

As mentioned, the nature of the product is also a factor. As all four RoRo companies confirm, the weight constraints of transporting forestry products on trucks determine the type of products being shipped. This is why paper rolls are mostly transported in high capacity transports such as the SECU loading units, by train or by using sea going vessels. Sawn timber due to its lighter character is more often transported by trucks. The size of the forestry company can also be a determinant factor, since the largest producers with enough volumes have their own logistics systems. Often times, these companies such as SCA or Holmen paper are located close to sea ports which promotes the use of maritime transport for the majority of the goods produced. Other large producers such as Billerud Korsnäs or Stora Enso are located further inland which makes the use of train more attractive. In addition, as companies R1 and R2 confirms, the routings of volumes are also determined by the location of the markets they are selling to or where the shippers have chosen to locate logistical hubs for consolidation or distribution.

All of the RoRo operators included in the case study agree that forestry industry transport chains are extremely sensitive to price. As company R1 explain, cost is the most important factor but other criteria have to be filled as well, such as lead time and capacity. R1 does not loose a lot of business from forestry industries due to lead time issues, but mixed cargo is sometime lost because it takes too long with RoRo, and it is faster to drive all the way to the continent. When asked if the congestion factors on the roads bound for continental Europe would influence the use of more multimodal transports, company R1 confirms this view. However, multimodal transports are still not utilized enough in forestry transport chains. The problems are due to pre and post-haul, making the cost per kilometer much higher (they are normally paid per job and not per km). Moreover, R1 thinks habitual factors along with flexibility concerns are hampering

the use of multimodal freight transport in the forestry segment. The consensus as a shipper is as follows; if something happens with the railway, there is definitely a stand still, but on the road there are always more options. Furthermore, R1 concludes; on a normal shipment of forestry products, only after most of the fundamental criteria is filled including quality, safety, efficiency, price is considered.

Company R2 emphasize on the importance of maintaining capacity but also frequency in order to optimize storage operations. Company R3 highlight one of the greater advantages of using short-sea RoRo shipping within this context. Accordingly, R3 explain the need of the forestry companies to ship their products in large batches one or two times per week. This procedure entails that large volumes are shipped in one go, and this is something that other modes of transportation cannot handle. As such, the following typical example was given in order to describe the dilemma; As a batch of 45 tonne of packaging materials can be loaded on mafi units with one tonne on each, only about one third of the main deck on a RoRo ship would be used for this batch of goods. On the other hand, only 30 tonne transported by truck, would require 60 trucks, all in one single day. The implications from an environmental perspective with emissions from all these trucks, with increased congestions on roads are given. However, the use of sea transport is on the other hand less flexible where the use of ports are mandatory.

Company R3 mention another important factor for the shippers to take into consideration, which is the stable price level of SSS and RoRo, compared to train. While the pricing of shipping is driven by pure competition and fluctuates with demand and availability, the heavily subsidized railway industry offers no such fundamental price mechanisms. Instead, train operators typically vary their price levels with extreme fluctuations, and unless you are a large shipper with bargaining powers, choosing to operate transports by train can be highly unpredictable. Company R4 confirms the same view and further explain; if a RoRo operator would like to offer door-to-door transport services by using train as a component, strategic partnerships with strong railway operators are absolutely vital and necessary. R4 who has a direct approach to serving the forestry industry by offering door-to-door solutions, also recognizes sustainability of transports as being on the top of the agenda for the larger forestry producers. Thus, environmental concerns are often voiced along with the need for secure handling of goods. As previously covered, environmental aspects can also be dealt with on a governance level, where legislation from local governments or the EU can impact the modal choice of shippers. In one such case, the SECA regulations, company R4 initially anticipated pricing pressure on SSO's, due to the need of bunkering low sulphur fuel or implement expensive fuel and exhaust gas scrubber technologies onboard their vessels. This could have had dramatic impact on the way shippers move their goods with the use of more land based transportation. However, since the price of bunker oil has remained low, no noteworthy shift has taken place.

4.2.2.2 Shippers

According to shipper S1, the availability of infrastructure and the cost of service are the main factors that shippers consider when sourcing transport. Moreover, the risk of damages is always assessed where too many transshipments will likely be a deterrent factor. Shipper R2 is acknowledging that frequency of service which is one of the strong points of RoRo is important. However, for the shipper there is no need for daily schedules but more on a weekly basis, which is a minimum. The frequency and accuracy of RoRo is also more robust than rail since the rail mode has incredibly varied lead times. Hence, if there is a lead time factor involved, then road transport all the way is being used instead of multi modal transports and RoRo. This is always case when the promise to the customer is jeopardized.

Furthermore, in line with the previously covered circumstantial factors, the transport mode also depends on the product produced amongst other factors. S2 explains; while packaging materials are profitable and there is more affordability when considering to choose sustainable transports, for other materials such as sawn timber, price is often the only determinant. Also, the nature of customers plays a large role. With a wide variety of customers with different operations, some, depending on products are less precise about delivery accuracy, while others need it on the clock. Factors such as location of the client also affect modal choice. For these reasons, shipper S2 assesses factors such as if the client has the ability to take on rail transport directly. Although for most of the clients, a transshipment to trucks is needed at the end before delivery to the client.

Shipper S3 mention price and the extra service of the transport company as being important aspects. The shipper relies on establishing a high level of trust through good contacts with the haulers, since the company offers a great deal of flexibility on their products. The service levels of the freight haulers will have to match accordingly. Sometimes the larger haulers do not accept this type of requested flexibility of loading windows. Another aspect mentioned is that although saw mills have traditionally been late in implementing sufficient IT systems, shipper S3 has come a bit further. They see clear benefits of real time availability of shipping information and therefore, they are more eager to expect the same level of sufficiency amongst transport companies.

4.3 Strengths and weaknesses of RoRo operators in PoG

In this section the results related to the sub-category research question, *'What are the strengths and weaknesses of RoRo shipping operations in PoG associated with their integration into multimodal forestry logistic chains?'* are listed and consolidated. The question and its related aspects serves as an important tool to complement and compare previous academic research about the competitiveness, strengths and weaknesses of SSS which will be used as a fundamental component towards the final analysis.

4.3.1 RoRo operators

As previously noted, RoRo can carry and sell a lot of capacity in comparison to other transport modes, but company R1 also identifies reliability and punctuality as major strengths over other modes. In the context of high capacity, compared to a trailer over long distances in a door-to-door transport chain, price will likely be an advantage. R1 concludes, ‘it depends to what you measure against’. Lead times are usually better with road transport compared to RoRo, and train. Reliability, shows similar patterns. RoRo is good over all in most major criteria, but maybe not number one in any of them. Nevertheless, company R2 sees frequency of service as a great strength as well as the flexibility of handling different types loading units and dimensions of cargo. R4 confirms the same attributes, but remains conscious and open to the higher price of shipping in loading units in comparison to bulk. Furthermore, the operator points out that competition is high which can be considered a strength for the industry as a whole, but a potential weakness for single operator slow to keep up with, or adapting to supply and demand forces. This topic will be further elaborated on in the next chapter.

As a weakness, the reliance of good port infrastructure can be a noteworthy factor. Company R2 has experience with bottleneck situations on the European continent where the flow of goods after being unloaded onto trucks are hindered access due to road congestions in port. Such an example could be found in Zeebrugge, where long line of trucks was the norm before important road infrastructure investments alleviated the situation. The dilemma touches on the core condition for RoRo to become efficient in forestry transport chains, where all stages of the transportation chain have to flow and work in harmony in order to avoid bottlenecks. Therefore, as company R2 acknowledges, ‘the whole transport chain has to be viewed as a whole’.

Company R4 elaborates further on the necessity of good port infrastructure, and especially since the RoRo operators have added to their new build portfolios, taking in new vessels with much larger capacity into operation. Thus, with larger vessels to be loaded and unloaded, the frequency of service can be affected negatively if infrastructure does not support such increase in capacity. Therefore, one should probably carefully consider the maximum size of the new RoRo vessels being built to avoid spill over effects on efficiency, which could threaten the promised strengths of frequency and punctuality of the service.

Perhaps the one issue that always seems to linger under the surface when discussing weaknesses and challenges of RoRo operators, is the port conflict issue in PoG. Most companies have experienced its effect first hand, where a drastic increase in flow of goods away from the container terminal, has created congestion effects within the RoRo operations. Should such symptoms persist, it could leave shippers with no other choice than to change their logistics routes via other ports such as port of Varberg for example. The implications could become of a serious nature, since once the larger shippers have made the decision to change and invested in infrastructure in a new alternative port, they will likely not go back.

4.3.2 Shippers

According to company S1, smaller saw mills in Southern Sweden have no problems sourcing inexpensive road transports to Europe, since all European trucks are passing this region. Therefore, they have a chance to fill their trucks with available capacity on the way back to the continent. S1 perceive the dilemma as a weakness for RoRo in PoG, and bring up the question why many of them therefore would choose to go via PoG? Further up north, in Mälardalen, they can also use forestry producers' systems and networks with terminals in place, where many times this is presumed to be a better alternative. Moreover, the shipper sees limited governmental focus on goods transports via rail as a weakness for PoG and its RoRo. Thus, since PoG to a large extent depend on rail to increase volumes of forestry products, the lack of planning and focus on this segment could fail to support large scale forestry goods transports via rail to the port. Also from a transport buyer's perspective, the shipper believes pre assumptive factors can stand in the way of using more rail transport, especially since its reputation is often perceived as negative. For these reasons, in a multimodal system, rail becomes the weak link in the transport chain and ultimately spells the same weakness for RoRo. Shipper S2 underscores the same issue and claim; too much dependency on rail with its unreliable lead times is a weakness for RoRo operators. As the shipper continues, 'any time the promise towards the client is in jeopardy, then road traffic is being used instead'.

Shipper S3 lifts an important aspects related to one of the core strengths of the RoRo shippers in PoG, namely the frequency of service; The mode is suitable for both large and small shippers of forestry products even if they have different logistical needs. While larger companies are transporting volumes that are continuously flowing throughout the year, the smaller ones are delivering more on a sporadic basis, due to fluctuations in demand from different markets. The larger shippers usually have long term client contracts, with frequent and predictable volumes, which provides stability for RoRo operations. However, all segments of forestry shippers are served with equal rights to secure transport. In this sense, S3 see the advantage of not being committed to fill a certain volume and it is perfectly fine to come and go as a shipper. Therefore, you always know that you have a spot onboard.

In addition, shipper S4 lifts the fill grade of the ships as a current strength. Accordingly, RoRo companies that are operating over 85% of capacity are profitable. Today, they are always running with full capacity so the RoRo business in PoG is going well. Shipper S4 has a hard time to find weaknesses and claims there are few since the volumes are there. However, besides some issues with cancellations which can effect frequency, unless RoRo operators begin targeting the goods owners directly, they are largely dependent on haulers for volumes, which can leave them vulnerable to shifts in demands and other competitive factors.

4.4 Strategies and service level of Short-sea RoRo operators

The below section lists the results from exploring factors related the sub-category research question ‘*What commercial and operational strategies can RoRo Short-Sea Operators in PoG follow in order to increase volumes of forestry products shipped via RoRo shipping?*’. The context of the results will largely be confined to prior academic research on logistics strategy and service attributes of SSS as listed in the theoretical framework.

4.4.1 RoRo operators

On the strategic level, company R1 emphasize on openness for all types of transport solutions towards the forestry industry. This can mean the possibility to offer cross-docking, such as the operations in PoG, or stocking capability in export destinations such as England or Belgium. Distribution capability and also IT systems, including EDI is often required by the shipper and is increasingly important. The company also values an understanding for pricing within each forestry industry segment and the ability to adjust accordingly. Cooperation with partners from other transportation modes such as the railway is important to be able to offer door-to-door solutions. When it comes to maintaining and developing a good service level, company R1 claims that it is becoming more and more important for shippers to establish stability and long term relations with transport companies. The shippers consider financial strength as important but also the willingness to invest in future aspects. ‘I.e. will this company survive and will it be able to offer competitive solution in the future?’ Hence, the key is to be able to offer innovative solutions and listen to the needs of the customer. The sales people as well as operators have a real responsibility to look at what the customer really wants.

For company R2 as well as R4, an important element of being a door-to-door transport service provider, lies in the ability to approach the forestry companies directly, rather than dealing with intermediary actors such as freight forwarders. One way to achieve a similar effect, is to through vertical integration with freight forwarders or haulers. With this structure, goods volumes can be routed via your own RoRo service, by using your own logistics providers. Indeed, company R1 and R2 are large enough to maintain and develop this sort of network, but as many of the operators are pointing out, it takes financial strengths in order to establish such as a business model. Another way would be to form strong partnerships through horizontal integration with other industry actors, such as in the case of company R4; The company has formed a strong alliance with a railway operator and thereby gained access to large forestry producers in northern Sweden. The RoRo operator have also connected railway operators in Europe in order to offer large capacity services after the RoRo transport leg. In addition to rail, company R4 also offers pre and post haul services by truck at origin and destination. With this setup, the RoRo operator can offer the whole transportation chain from northern Sweden all the way to client destinations on the European continent.

All of the RoRo companies describes the importance of a rigid quality management program in order to offer consistent service levels throughout the network. For R2, this is particularly a goal; thus it sees a strong connection to infrastructure investments, especially in ports, as a predetermining factor to maintaining quality. Again, the financial advantage becomes important since in-house logistics solutions including integration with road haulers would arguably facilitate in maintaining quality and a comprehensive service level. For company R3, the perspective is a bit different since they are a smaller company in comparison with the other three operators. Thus, it remains cautious of such expansions since it sees successful IT infrastructure between actors as a crucial in order to make it work. Comprehensive IT systems are often extremely expensive where different geographical locations or cultures between the actors enhance the complexity of implementing them. In this sense, R3 believes that consolidation trends vertically are limited to companies with strong financial muscles, while other actors can rely on strategic partnerships to expand door-to-door networks.

4.4.2 Shippers

One of the most important aspects for shipper S2 when overseeing transports of goods is the flow of information and its transparency. Shippers need to have control over flows and know the whereabouts of all products at all times. Therefore, EDI technology or other forms of tracking systems are imperative. Stable and reduced points of contacts are also important factors. If communications are too wide spread and if there is a difference in quality between say the RoRo company and the logistics provider (under the same company name), then it becomes a difficulty for the shipper. Therefore, integration with road haulers and/or other transport modes can be advantageous but only if the service level is collectively maintained and all flow of information is available throughout the transport.

Shipper S2 explain why it is especially important with information transparency in the paper segment; The output of paper products vary due to capacity fluctuations and the clients understand this fact. However, clients are also expecting proactivity and to be informed about delays. This puts pressure on transport providers to sufficiently provide delivery information in real time. By the same token, shipper S3 spontaneously feels that further integration of IT systems would be beneficial for RoRo companies. Thus, the shipper would prefer an information portal where the clients can view status of shipments. This would save the client and the operator a lot of time since unnecessary emails back and forth with status reports, could then be avoided. As a consequence, the shipper would then be able to increase service levels towards customers and further believe that the RoRo operator who could manage such integration of IT systems could have a great advantage.

Shipper S4 thinks that the best way is to work with the forestry industry directly. As the road hauler insists, this approach would allow them to secure large volumes from strategic companies although some RoRo operators are only working with other haulers such as LK Walter, DHL and

DSV. Moreover, Roro companies should be more concerned about the type of goods that are shipped in their vessels, and not only consider volumes in terms of loading units. The shipper believes this is a mistake and instead they should target the industries directly including forestry companies. This is the way forward to secure the large volumes.

4.5 Summary of key findings

In general, the forestry industry is performing well and the outlook is promising for future growth. For domestic as well as European transportation providers and actors, it bodes well as the reputation of being the largest transportation buyer per industry may continue to flourish.

As it currently seems, the global downshift in the use of print paper has not meant that the industry has had to make drastic reductions in overall production, but rather a refocus on other products which are more in line with future demand patterns. For transporters, such as RoRo operators in PoG, volumes are as abundant as ever and there are no clear indications that things are about to change. However the industry has become increasingly price conscious, where the implications of using shippers own logistical systems compared to the use of other freight transport methods are constantly being assessed. The in-house tailored transport systems are of course capital investment heavy, especially with seagoing vessels and port terminals within ownership. The alternatives on the other hand are many times too unreliable and too costly in order to be feasible enough to handle large volumes. Transports by train have a negative reputation amongst shippers as being unreliable and prone to long delays. The train operators are also known to be unpredictable when it comes to offering a stable price level and there is little trust to support long term use. Road transports are mainly driven by price and primarily utilized by saw mills depending on the location. Furthermore, the amount of northbound imports of other goods, determines the use of road haulers.

For RoRo operators in PoG, the shared positive outlook for volumes has resulted in a series of new-build projects adding up to 50% more capacity on some of the vessels. In an industry where efficiency is key, the demands on loading/unloading operations as well as transshipment processes from trains onto cassettes, trailers or mafi units are likely heightened. However, with the increasing focus of providing door-to-door service. Sufficient efficiency in PoG may not be enough. On the contrary, unless infrastructure is being built throughout the transport chains to support this increased capacity, the RoRo sector in PoG risks over-reaching its capabilities. Currently, the main area of concern are some of the European ports and consolidation points of the large forestry producers such as Zeebrugge in Belgium. The spill-over effect of a bottleneck situation to the rest of the door-to-door transportation chains can easily be imagined.

Many of the actors in the study believe that shippers in-house sea transport systems will prevail in the future but thinks rail transports will increase in the face of higher environmental standards. Thus sustainability of freight transports are continuously moving higher on the shippers agenda

when evaluating modes of transport. A potential hurdle for the RoRo companies in regards to looking for increasing volumes, is the cooperating activities of the shippers from ports on the east coast of Sweden. Regarding the SECU system used and operated by Stora Enso, most of the actors studied believe that there is limited potential in the long term. Reasons offered include a lock-in effect with specialized RoRo vessels, lack of flexibility, age and limited reverse flow of goods when shipping them back to Sweden. Again if replaced by other loading units, operators involved in transshipment operations would have to be able to handle higher volumes.

Amongst the criteria that determine the mode of transports of forestry products, there are both circumstantial factors, such as the location of the shipper or the nature of the goods being shipped. Hence forestry companies in the north of Sweden will have to transport their goods over long distances and sea freight is often most the economical way. At the same time, for paper rolls the weight constraints often leaves only sea or train as viable options. Geographical aspects are also applicable to the location of the customer, where modes may vary depending on the distance of the transport chain. However, amongst the variable factors, price is almost always a primary concern. Other criteria have to be filled as well, such as frequency, lead time and capacity. In addition, the quality and safety of transports are key demands in the sector. For larger producers, sustainability of transports is often highly considered and in this aspect RoRo shipping has a positive reputation. Flexibility of transport is also a factor that transport buyers take into consideration. This could be the case for transport that are urgently needed and so trucks are usually the optimal choice. Thus, if something happens with the railway there is a definite stand still, but on the road there are always more options. In addition to the above mentioned criteria perceived by the RoRo operators, the shippers are often assessing if door-to-door transport chains has sufficient infrastructure to support efficiency throughout the supply chain. Thus, rail operator networks as well as accessibility and the efficiency of transshipment operations in ports are carefully assessed. The transparency of information is also highly requested amongst shippers. They see clear benefits if real time availability of shipping information could easily be accessible throughout the transport chain.

The strengths and weaknesses of RoRo operators in multimodal transport chains for forestry products can be summarized as follows: From the operator perspective, high capacity and frequency of service are viewed as valued attributes. They also view the mode as a reliable way for shippers to move their goods on a punctual basis. Moreover, the flexibility of a RoRo ship with its horizontal loading capacity allow the mode to handle a variety of different load carriers, with different weight and dimensions. A good thing with RoRo is that forestry shippers are not committed to fill a certain amount of volumes and that it is acceptable to come and go as a shipper. Therefore, shippers always know that they have a spot onboard. RoRo is a highly competitive business which can be seen as both a strength but also a weakness, depending who is asked. Although the mode as a whole would likely be benefited by being viewed as competitive from a shippers perspective. The current fill grade of the ships is a strength. With current

volumes, they are always running with full capacity and the RoRo business is performing well. On the negative side the operators are conscious of the fact that port infrastructure dictates the success of their business, and if union conflicts are common this will also have a negative effect on the mode. Some of the shippers are pointing at the dependency of rail services for achieving high volumes. As such, the lack of government planning and focus on improving efficiency in and capacity in the rail segment could fail to support future large scale goods transports by rail to and from the port.

Regarding commercial and operational strategies, an openness for all types of transport solutions towards the forestry industry is mentioned. This can mean the possibility to offer cross-docking, in port or stocking capability in export destinations. Moreover, distribution capability, sufficient IT systems, including EDI is often required by the shipper and is becoming increasingly important. Furthermore, an understanding for pricing within each forestry industry segment and the ability to adjust accordingly is viewed as an important attribute. To integrate horizontally with other actors, cooperation with partners from other transportation modes such as railway services becomes important offering the shipper a joint solution. Part off the push to become door-to-door transport service providers lies in the ability to approach the forestry companies directly, rather than only dealing with other actors such as freight forwarders. For some RoRo operators, vertical integration strategies with freight forwarders and logistics providers have been the answer. The caveat is the need for financial strength and not all RoRo operators in PoG have this possibility. Furthermore, for such large organizations, rigid quality management programs used to ensure consistent service levels throughout the network become important. Often times sophisticated IT-systems are considered to improve information flow and transparency within transportation chains. Indeed, if several sub-organizations are represented under one service provider, where the RoRo operator essentially controls the door-to-door transport chain, coordination and integration of IT systems are probably needed. The question is how sophisticated the system should be as they can be extremely difficult and costly to implement. Under such circumstances, it may be a better strategy to stay with a more manually oriented system, which are often used between RoRo operators and shippers today.

Chapter 5 - Analysis and discussion

In the following section the empirical results from the case study will be discussed and analyzed in accordance to established theory on SSS strategy, competitiveness and transport modal choice in relation to multimodal logistics chains. More specifically, similarities or deviations between findings and previous theoretical literature in regards to RoRo short-sea shipping will be compared and elaborated on. Finally a SWOT analysis, (see Table 1) will be used to divide important findings into areas of strengths, weaknesses, opportunities and threats, to further develop a basis to the research questions, suggestions and recommendations for RoRo operators in PoG.

5.1 Competitiveness short-sea shipping in multimodal freight transport

As theory suggests, companies of today are increasingly focusing on fully integrated supply chains in order to gain competitive advantage, in an ever expanding global market place. Thus, to become market leaders they strive to shape their supply chains to be time-responsive, flexible and agile (Cooper, 1993; La Londe and Masters 1994; Lambert, 1992). For RoRo shippers in PoG, when serving intra-European forestry chains, the same focuses are constantly taken into consideration, on both a strategic and operational level. Being some of the strengths of the sector, RoRo operations are indeed flexible when it comes to load carriers combined with high frequency of service on a strict time line. However, one strength that work in favor for the RoRo operators, especially in regards to forestry chains, is the ability to absorb large volumes on a short time frame. Therefore, from a capacity perspective, the transport mode via PoG is arguably hard to challenge. While theory mainly focuses on areas such as network design and speed amongst other factors (Paixao & Marlow, 2005), the attribute to quickly absorb large capacity is covered more scarcely. Indeed, the operators have realized this potential as a competitive advantage over other transport modes, and are building the next generation of RoRo vessels with even larger capacity. With this in mind, the PoG operators could strengthen their position of forming the backbone of forestry logistics chains, where other modes become support functions, offering pre and post haulage in door-to-door forestry logistic chains.

In order to control the flow of physical goods, it is also important to control the flow of information; Just as Casaka and Marlow (2005) describes regarding the difficulties in tracking, tracing and sharing information between European logistics providers within the short-sea segment, RoRo shipping operators in PoG are dealing with the same issues. Identified as one of the weaknesses, the flow of information can be slow due to the often manual nature, where at the same time the pace and efficiency of the physical handling of load carriers is high. Many times, this leaves shippers with the only option of having to ask for shipping status, as there is little time for automatic delivery information in real time.

Moreover, as theory regarding European SSS operators suggests, there is a strong emphasis on aspects more operative in nature such as frequency of service compared to more value added factors, such as relationship-building characteristics. Further suggestions in theory describes SSO's as rather complacent when it comes to establishing direct contacts with the goods owners themselves, as they often often rely on freight forwarders as main point of contacts (Casaka and Marlow, 2005). In this sense, the results of the study of PoG RoRo operators partly confirm this view but only to a certain degree. In fact, most of the RoRo operators in the study are already strategically reaching out to the goods owners directly with door-to-door offerings, or at least they are acknowledging the fact that this is the way to move forward. For the above reason, amongst the service attributes covered in theory which becomes highly relevant after conducting the study, *Carriers representative's sales and after sales behavior; Commercial/operational and carrier-shipper's relationship policies; Involvement in the forwarding industry*, should form the basis of strategic activity focuses. These relationship building policies should of course be pre positioned by *logistics network design, cost and speed* as well as *quality and reliability* of services. In the next section the different areas of strategy to achieve sufficient service level and competitiveness laid out in theory, will be compared to the case findings.

5.2 Logistics strategy for SSS operators in multimodal transport chains

As previously outlined in the theoretical framework, in order to be effective and to make full use of its potential, SSO need to be able to offer door-to-door transport services with a seamless integration of different transport modes. In order for PoG RoRo operators to achieve these objectives in forestry logistics chains, such a set up requires the development of extensive and strategically important best logistics practices (Coyle et al, 1992).

Based on the empirical findings, perhaps the most fundamental area of strategic focus should be on *adopting integrative strategies*. Thus, both RoRo companies and shippers confirm that in order to develop a seamless integration of different transport modes, a network approach needs to be in place, where infrastructure, transport operators and facilities are connected. As Paixao and Marlow (2009) suggest; within this door-to-door transport chain, collaborative attitudes between the RoRo operator and its customers becomes possible. In terms of connectivity and network with other modes of transports as well as port infrastructures, to sustain efficient operations, the RoRo operators in PoG are according to the findings already well positioned.

At the same time, the RoRo operators are also well adopted to other business strategies outlined by theory in order to sustain and grow their volumes of forestry products. Firstly, two of the larger RoRo companies in PoG are *adopting a freight-forwarding strategy* where they own their own cargo logistics divisions, providing road haulage. As Bergquist and Monios (2016) explain; freight forwarders often become experts in logistics networks, where they can influence multiple

modes of transport to move goods and thereby control the physical flows of forestry products. However, for the remaining RoRo operators, due to market pressures and limited company size, to vertically integrate with freight forwarders requires tremendous financial strengths and therefore not always a feasible option. On the other hand, *a partnership strategy* can also be used to achieve economies of scale and to successfully integrate with multimodal transport chains. As Paixao and Marlow (2009) indicate; the forming of strategic alliances is often key in order to survive in an increasingly competitive SSS market. As an example, both RoRo companies R3 and R4 uses strategic partners when offering door-to-door services to forestry shippers. In one case, R3 partner with a separate RoRo company operating between ports in mainland Europe to offer access to a port in southern Europe, which otherwise would be out of the PoG operators reach. In a similar fashion company R4 offer a seamless door-to-door transport service to a southern European destination, by sub contracting European rail and trucking companies.

None of the above strategies would be sustainable in the long term without a *total quality management approach*. Just as Jacobs and Lummus (2014) explains, this aspect focuses on achieving a customer oriented organization, while involving all employees in continual improvement. As the shippers in the study confirm; culture and activities of the transport provider ultimately dictates the perception of performance. Thus unless the RoRo operators can utilize strategic data and effective communications to infuse a discipline of quality throughout door-to-door transport chains, shippers always have the option of finding another company to handle their transportation. For some shippers, such quality performance could for example mean a direct contact with one single representative from the RoRo operator despite several operational divisions within the transport company.

Perhaps the most important determinate of quality performance is the ability to offer transparency and possibility to track a customer's cargo throughout the transportation chain. Therefore, for optimal service level, *a time-management strategy* (Paixao and Marlow, 2009) becomes a crucial part of the service attributes for PoG RoRo operators. In this sense, well implemented information systems are crucial elements in order for RoRo operators to maintain unbroken, timely transports.

5.3 RoRo in PoG: Transport modal choice

The theory of modal choice outline the distance and the differences between national and international freight transports as the most fundamental factor to take into consideration when deciding on transports (Vierth et al. 2012). For intra-European forestry logistics chains carrying low value goods, these parameters are especially important since the longer distances are qualifying factors for any transport mode choices outside that of road. As this paper have shown, there is an ongoing struggle between using more train and SSS, including RoRo in PoG in

forestry logistics chains, instead of solely relying on road transport. For sawn timber products, this is especially true since as long as inexpensive and abundantly available flow of trucks offer forestry companies a direct route to intra European destinations, RoRo services in PoG risk being seen as a secondary option. This means that if the volumes are not big enough or the use of multimodal options are not economically competitive enough, forestry companies will mainly go for the least expensive option, which many times is road haulage. However, depending on the location of the shipper, the size and volumes produced, PoG and RoRo may still offer advantages to the haulage of semi-trailers due to the favorable qualitative factors such as *flexibility, frequency, reliability, on-time, speed* and *security* that are often compared to the *price* of the transport (Vierth et al. 2012). In general, these are all factors considered by the shippers in the study along with the nature of the goods itself and to what extent shipping parcels can be unitized (Ahlberg, 2016). Therefore, for the RoRo operations in PoG, an openness and cater ability towards all segments in the Swedish forestry industry, regardless of location or size becomes crucial. On the above accounts, Vierth (2012) describes the modal choice process which correlates with the forestry industry very well. In addition, one factor which is becoming increasingly important amongst the larger forestry shippers is transport sustainability. In this sense RoRo as a sector has the advantage, especially if connected with train transports in multimodal door-to-door chains, due to low emissions of Co2 ratio compared to road. Amongst the empirical findings on modal choice factors that are not extensively covered by theory, is the large capacity of RoRo to absorb large volumes of goods on short notice, as well as the flow and transparency of information.

The results relevant to research objective have now been discussed and analyzed in context with the literature review. In the below section a further categorization of the results into a SWOT analysis will be conducted.

5.4 SWOT analysis

5.4.1 Strengths

The RoRo operators in PoG offer a transport mode that has a high capacity and frequency of service and currently there is no shortage of volumes to fill this capacity. With future new-building projects offering up to 50% more capacity coming into the market, the sector will be well aligned for future growth of forestry product shipments. Shippers also view RoRo operators in PoG as a reliable way to move goods on a punctual basis. The delivery promise to the end user is high on transport buyers agenda and so the RoRo leg of the transport chain serves as a rigid foundation of time management within transport chains. One of the inherent strengths is the flexibility of a RoRo ships operating in PoG, as they can handle a variety of different load carriers, with different weight and dimensions. The cross-docking facility in the port offers

efficient transshipments from train to cassette or mafi, and a new combi terminal planned to be built can further support transshipments of trailers on intermodal transports.

The RoRo industry in PoG is priced based on free market principles with acceptable price fluctuations, which is perceived as positive for the shippers. On a door-to-door perspective, the challenge is to offer competitive pricing where also train and truck operators are involved. Therefore close cooperation or integration with train operators is important for pricing stability purposes. The RoRo shipping mode scores high on sustainability and especially since its operating in SECA controlled waters. Large shippers can take advantage of these attributes which are paid for by the RoRo operators themselves by lowering CO₂ or sulphur emissions from their vessels.

5.4.2 Weaknesses

One of the weaknesses for RoRo operators in PoG is that port infrastructure dictates the success of their business. This is of course not the case in PoG, where efficiency and capacity is currently sufficient, but they are also affected negatively if European ports on the receiving end of the RoRo sea leg are unable to handle current and future volumes. For these purposes, persistent lobbying for infrastructure developments to support expanding forestry supply chains with PoG and its counter parts becomes important.

The dependency of rail services for achieving high volumes of forestry products can be perceived as a positive factor due to the added economies of scale. However, the successful train shuttles between PoG and forestry companies located in the mid south region of Sweden are an exception with volumes and capacity already built in. Furthermore, the train operators are often competing under strict governmental regulations, where pricing and availability is not formed under free market principles. This usually cater to those shippers with large enough regionally based volumes or financial influence. If RoRo in Pog are to absorb more volumes from the northern parts of Sweden, or from smaller inland shippers who would have preferred this mode for any reason, then railway services and its infrastructure will have to be developed to support longer distances of goods transports as well as accessibility commercially to smaller shippers. As things are today, large shippers in these regions are instead relying on sea transports for shipments down to the European continent which doesn't add much benefits for PoG operators, while smaller shippers are not offered pricing that is competitive enough compared to road.

For the same reasons, the large forestry producers in the North, will only consider PoG as a secondary option outside their own transportation systems. Usually, when there is disruption in production, goods for customers bound for the UK are shipped via truck through Sweden down to PoG and then via RoRo. This means unpredictable volumes of forestry product are often routed via the port and difficulties to accurately forecast demand is always a disadvantage. For smaller saw mill shippers who primarily used road transports, imbalance in import/export road

transport volumes allows them to source inexpensive foreign road haulage. This means that PoG is not likely considered when it comes to routes to continental Europe.

PoG RoRo operators are aiming to offer door-to-door services, but often the flow of information is dealt with on a manual basis. Thus, there is limited time to provide delivery information to clients unless requested. Furthermore, they have little control over which goods are shipped on each ship. Therefore a shippers batch of goods can be broken in segments and shipped on several sea journeys. This is a disadvantage to the shipper who can only invoice their customer once the full order has been shipped. Finally, the perception amongst shippers as well as customers of forestry products, amongst all other industries in Sweden are perhaps affected by the ongoing union conflicts in PoG's container terminal. If unresolved, the long term negative consequences can have a spillover effect, which has already occurred to some extent, to the RoRo terminal. Thus, large volumes have instead been routed via RoRo effecting loading efficiency and time schedules.

5.4.3 Opportunities

Regarding the SECU system used and operated by Stora Enso, most of the actors studied believe that there is limited potential for using them in the long term. If being replaced, paper rolls will have to be shipped in conventional loading units and this could mean an increasing number of shipments for the RoRo companies in PoG. According to port officials in PoG, the number of SECU's is gradually being reduced. The transparency of information is also highly requested amongst shippers in the forestry industry. They see clear benefits if real time availability of shipping information could be easily accessible throughout the transport chain. The challenge is to integrate these systems to include all modes of transportation. Thus, a RoRo operator who could be on the forefront on successful integration of IT systems accompanied with effective tracking technology could have the advantage.

Part off the push to becoming door-to-door transport service providers lies in the ability to approach the forestry companies directly, rather than only dealing with other actors such as freight forwarders who happen to use RoRo in PoG for their shipments. The true advantage of securing volumes comes when the whole transport chain is being controlled and dictated by the RoRo operators. Accordingly, they can either vertically integrate to absorb logistics providers, road haulers or train operators or integrate horizontally, cooperating with strategic partners from other transportation modes, including railway services, to offer joint solutions towards the shippers. Sustainability of freight transports is continuously moving higher on the shippers agenda when evaluating modes of transport. Therefore, it is believed that more and more transports by train lie in the future of forestry logistics chains. With the anticipated higher use of train, but also sea transport, it is important that the port infrastructures are able to handle a gradual shift towards their use.

5.4.4 Threats

Since PoG is to a large extent depending on efficient and high quality rail services in order to sustain or increase volumes of forestry products, any lack of planning or focus on improving efficiency in this segment could fail to support future large scale rail transports to and from the port. Thus the key lies in attempting to influence the stakeholders, often on a governmental level to upgrade and develop the sector to support large scale goods transports of forestry products throughout Sweden. For RoRo operators in PoG, the shared positive outlook for volumes has resulted in a series of new builds, with up to 50% more capacity on some of the vessels. In an industry where efficiency is key, the demands on loading/unloading operations as well as transshipment processes from trains onto cassettes, trailers or mafi units, will likely be strengthened. However, with the increasing focus of providing door-to-door services, efficiency improvements in PoG may not be enough. Thus, unless infrastructure developments are being matched throughout the transport chains to support the increased capacity, the RoRo sector in PoG risks over-reaching its capabilities. One of the more unanticipated factors conveyed during the interviews, which could prove to be a potential hurdle for the RoRo companies in PoG, is the way that the larger forestry companies, such as SCA, are cooperating with smaller shippers and logistics companies to fill their own fleet of ships with goods volumes. If such cooperation and coordination between goods owners and transport companies would become increasingly successful, then perhaps the larger goods owners own transport solutions would continue to develop and take precedence in major logistics flows to continental Europe as well as the UK.

Table 1 SWOT Analysis for RoRo shipping operators in PoG.

Strengths	Weaknesses
<ul style="list-style-type: none"> • Capacity: Operators offer high capacity with high frequency which is what shippers will increasingly demand. • Reliability: The PoG operators offer high reliability of punctuality as well as safe handling of forestry product goods. • Flexibility: By being flexible when handling forestry goods, the operators can swiftly adapt to any type of load carrier • Pricing: The pricing of RoRo in PoG is perceived as stable compared to other modes of transports such as train. • Sustainability: The mode scores high on sustainability and especially since its operating in SECA waters. Shippers can take advantage of these attributes which are paid for by the RoRo operators themselves by lowering CO2 or sulphur emissions from their vessels. 	<ul style="list-style-type: none"> • Road-haulage is inexpensive: Due to trade flows imbalances, forestry shippers have no problems sourcing inexpensive foreign road haulage destined for continental Europe. • Control of information: Flow of information is often manually based, leaving no time for delivery updates unless asked for. • Cargo planning: A shippers batch of goods can be broken in segments and shipped on several sea legs and is perceived negative by shippers. • Dependency on Infrastructure: Sufficient port and rail infrastructure dictates the future success of the operators. • Dependency on rail: High dependency on rail services for achieving high volumes of forestry products. (Only a chosen few have access to train)
Opportunities	Threats
<ul style="list-style-type: none"> • Replacing SECU's: More load carriers shipped via RoRo in PoG. • IT system integration: Door-to-door delivery information is sought after by the shippers. RoRo operators on the forefront on IT integration can potentially have an edge. • Direct offer: To go directly to shippers, means to potentially having greater control over volumes and transport chains. • Integrate: With other transportation modes including railway services to offer a solution together towards the shippers is key. • Sustainability: Shippers will increasingly choose sustainable transports for part of their volumes. → liaison with train operators for a sustainable door-to-door option. 	<ul style="list-style-type: none"> • Neglect of the train sector: RoRo operators should influence stakeholders, often on a governmental level to upgrade and develop Swedish train network. • Infrastructure investments: The RoRo operators will have a lot more capacity in the near future. Unless port infrastructure is matched, then there may be efficiency constraints and bottle necks in the transport chain. • Forestry companies own logistics systems: If cooperation and coordination between goods owners and transport companies continues to grow it could take precedence in major logistics flows to continental Europe as well as the UK. • Complacency: Lack of communication with goods owners, relying to heavily on freight forwarders poses a threat.

Chapter 6 – Conclusion

This final section presents conclusions drawn from the theoretical as well as empirical study previously outlined. The analysis and discussions in chapter 5 form the basis for the conclusions which will be given by answering the research questions which have guided the research study. Suggestions and recommendations to RoRo ship operators in PoG will be provided accordingly. Finally, suggestions for further research will be given.

6.1 Research questions

The main purpose of this study was to investigate how RoRo companies in Port of Gothenburg can improve integration within forestry logistics chains for intra-European exports. By gathering empirical first hand data from the RoRo operators themselves and the shippers who are representing the goods owners, a thorough understanding of the logistical needs and trends that effects transport modal choice in forestry logistics chains has been determined. Moreover, as part of the scope, the objective was to determine how PoG RoRo companies can use strengths and levitate weaknesses to form important strategies ultimately enhancing service levels. After the specific findings were analyzed and compared to existing theory around the topic of SSS competitiveness and strategy within multimodal transport chains as well as modal choice, a framework for suggestions and recommendation has been developed.

Within this context, the main research question below will now be answered, by answering each sub-question as previously outlined in chapter 1.4.

How can RoRo short-sea shipping operators in Port of Gothenburg improve integration into multimodal forestry logistics chains?

How do the current and future logistical needs of Swedish forestry companies influence their transport mode choice?

Outside their own logistics chains, forestry companies form their decisions based on only a few principles. As found, for the larger producers located in the north of Sweden, only volumes of goods that are shipped due to disruptions in production are normally accessible to PoG and RoRo. However, under these urgent conditions, the main criteria that are considered, are price, speed and flexibility, and therefore road transport by truck is often the given choice. For smaller saw mills distributed around Sweden, the same criteria apply in general. For intra-European transport destinations other than the UK, unless RoRo from PoG can provide economical incentives for the price of a sea leg, or a faster service compared to road transport, truck haulers

will likely stay on the roads all the way to the final destination. Furthermore, port infrastructure determining loading and unloading efficiency as well as accessibility to ports becomes important determinant factors for road haulers choosing RoRo. The mode has a capacity advantage over other actors and therefore it is often utilized by larger shippers located in regions within its favorable reach. Train is often a part of multimodal transport chains for these shippers due to favorable networks and train operator density, which serves as a large benefit to PoG.

What are the strengths and weaknesses of RoRo shipping operations in PoG associated with their integration into multimodal forestry logistic chains?

By nature of strengths, being a high frequency mode with a high rate of safety and reliability, RoRo services in PoG seems particularly suitable for shippers with large continuous flows of forestry products, seeking a stable price level and a sustainable option. In this sense, the same shippers are less concerned with ‘when and where’ an actual consignment or loading unit is located within a door-to-door framework, whereas smaller shippers with more sporadic shipments often require more attention. In general, the perceived lack of transparency of information can become a challenge for shippers who are servicing clients with increasing demands on deliveries. The flow of information is arguably often slow and manually driven, which can effect cargo planning and on occasions lead to batches of goods being partially shipped. Furthermore, by its physical location and being a part of port infrastructure, PoG RoRo is dependent on a well functioning port network with transshipment and cross-docking efficiency. While not being a weakness at the current time in PoG, but more of a potential threat, any substantial lagging of infrastructure investments in receiving European ports, could derail door-to-door transport efficiency. As a mode that is largely dependent on forestry products transported by train to PoG, the limited accessibility for a broad enough spectrum of Swedish shippers by size and location becomes a potential constraint for future volume increases to the port.

What commercial and operational strategies can RoRo Short-Sea Operators in PoG follow in order to increase volumes of forestry products shipped via RoRo shipping?

To make full use of its potential, PoG RoRo needs to continue to develop door-to-door transport services capabilities with seamless integration of different transport modes. By adopting these *integrative strategies*, a strengthened network approach where infrastructure, transport operators and facilities are connected leads the way forward. This setup enables collaborative attitudes between the RoRo operator and the shippers. A more direct approach towards the goods owner, i.e. the forestry companies, has been suggested by both RoRo companies and shippers as a way to enhance knowledge of specific needs and criteria that effect modal choice. In this sense, unless RoRo companies have already vertically integrated with freight forwarding, strategic

partnerships with other transport mode operators would seem necessary. Examples could be to form strong alliances with train operators with an operative network reach from northern Sweden to PoG and similar alliances with European train or trucking operators. With a successful setup RoRo operator would then have the potential to offer a seamless door-to-door transport chain to intra-European destinations directly to the customer. Further, it would likely be beneficial to promote the environmental sustainability of the mode since large forestry companies are increasingly pressured to show improvements on the area within reports. In order to maintain quality and service level in such supply chains, a well implemented *time-management strategy* could offer the ability to enhance transparency and the possibility to track a customer's cargo of forestry goods throughout the transportation.

6.2 Suggestions and Recommendations for RoRo operators in PoG

After both theoretical studies and external industry research have been conducted, the research question has been answered. The following recommendations are based on the research presented throughout the thesis and can hopefully add some value to the way RoRo companies in PoG will move forward in regards to integrating with multimodal intra-European forestry logistics chains.

The RoRo operators should strive for becoming a part of and integrate with the forestry companies main supply chains to the largest extent possible. The larger more continuous flows of forestry products, allow the RoRo operators to fully utilize its core operational attributes of frequency, reliability and safety as well as sustainability of transports. In order to do so, RoRo operators can develop more service-oriented goals and objectives and form alliances or integrative long term strategies with shippers. In order to mediate some of the identified weaknesses or constraints, RoRo operators should improve direct communications with forestry shippers in order to understand the varying needs of the industry, and where applicable, offer environmentally sustainable door-to-door transport directly to the goods owner. Furthermore, RoRo operators should focus on long term influencing efforts with all stakeholders and actors involved in the development of sufficient future port infrastructure, including port owners and operators, as well as the corresponding actors in the railway sector. The benefits of such focus could be increased control over door-to-door forestry logistics chains. Also, it could ensure that increased load capacity is being met with matching volumes of forestry products in the future. The RoRo operators are recommended to develop or improve IT systems in such a way that delivery status and information becomes more available to shippers. In this respect, a “one size fits all” solution with large ERP systems are likely not the proper solution, due to the complexity of transport networks and various sophistications of business processes amongst the actors involved. However, unless the shippers are content with an unsystematic or automatic approach

to delivering information, the RoRo operators should strive for on continuous improvements of IT systems, to coordinate and integrate where possible on a door-to-door basis.

6.3 Future research

The potential areas for future research around SSS and forestry logistics are many. Firstly, examples of opportunities to investigate deeper into factors within this research gap, can include the trade-off effect in terms of transport costs of owning and operating sea going vessel vs outsourcing transportation to the many actors in the forwarding industry. Moreover, to gain a deeper understanding of the mechanisms that govern transport flows of forestry products, a selective approach of studying a single product such as sawn timber could perhaps provide more specific results depending on its use. Perhaps a segmentation approach between larger and smaller forestry producers could also add value on a more specific level. On a macro perspective a more comprehensive approach could be to study international forestry supply chains to third party countries, where RoRo also plays a role in maritime transport. Another aspect that could be interesting for future research could include the potential impacts of SECA regulations on forestry logistics chains in reference to SSS and RoRo. On a similar note, investigations could be directed towards global supply chains of forestry products affecting the container ship industry, where impacts of environmental regulations could potentially affect ratios between sea and land transports. The possibilities are endless where the growth of the Swedish forestry export industry along with increased sea transportation leaves room for many interesting case studies in the future.

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Appendices

Interview guideline – RoRo ship operators & Shippers

1. What is your position and duties here at company X?
2. What is the nature of your company's services/operations?
3. Who are the primary buyers of your service? (If RoRo company)
4. What is your experience regarding the forest industry and its logistics needs?
5. Can you estimate the volumes of shipped forestry products shipped via RoRo within Europe?
 - Paper?
 - Pulp
 - Sawn Timber?
6. What factors influencing modal choice for transport buyers of forestry products?
7. What factors or events are needed in order for forestry shippers to use more standard transports chains vi RoRo instead of their own transport systems?
8. What factors or events are needed in order for forestry shippers to use more standardized load carriers vi RoRo instead of their own tailored load carriers such as the SECU?
9. Are there any differences between large and small forestry companies on how they use RoRo shipping and in relation to early unitization?
 - For instance larger companies probably uses trains where the goods have to be transshipped to RoRo vessels.
 - Smaller companies probably uses road with semi-trailers
10. Is RoRo shipping used more in the forestry industry's own logistics chains or is it used more when purchasing transportation, the conventional way?
 - Explain your answer
11. What are the most important strategies company X can take in order to increase its shipped volumes of forestry products?

12. What are the strengths and weaknesses of RoRo traffic in relation to forestry logistics chains?
13. What can your company do to increase your service attributes towards buyers?
- Logistics network design and speed
 - Cost of service/freight rates
 - Reliability and quality
 - Carriers rep sales and after sales behavior
 - Investment policy
 - Corporate image
 - Carrier-shipper relationship policy (commercial and operational)
 - Forwarder industry involvement
 - Service guarantee
14. What are the biggest obstacles for RoRo operators to integrate into multimodal transport chains of forestry products? (e.g. transshipments are expensive)
15. Do you know any other person/company/organization that you recommend me to speak to regarding this case work?