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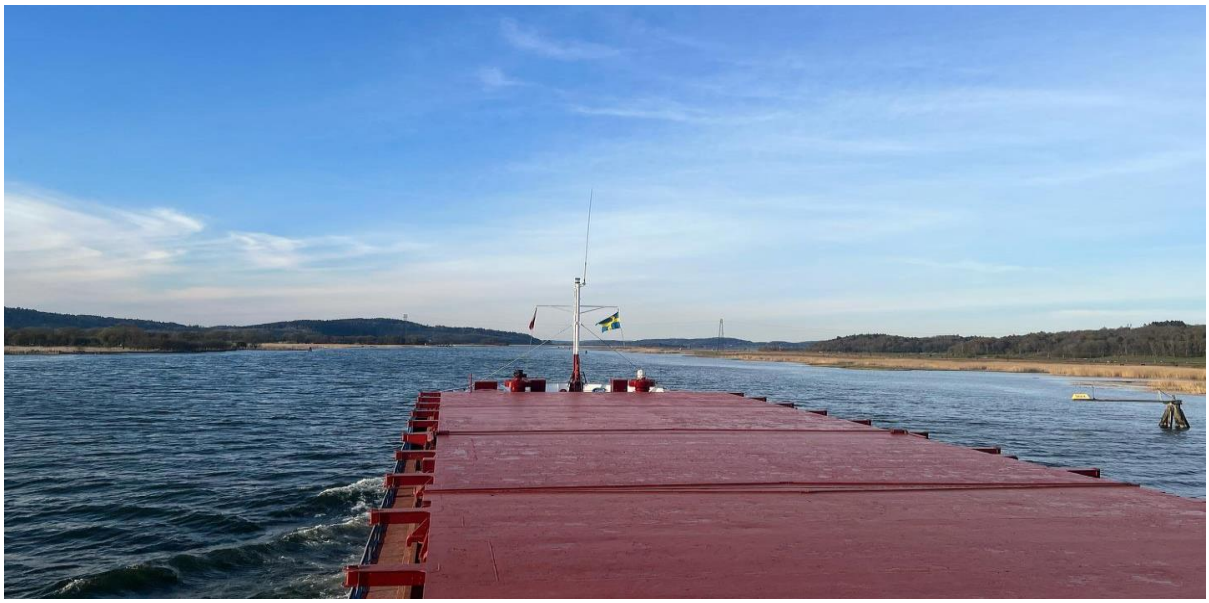

Inland waterway transport of containers on Göta älv in Sweden

Stakeholders' opinions and logistic suppositions of the transport mode

Bachelor thesis for International Logistics Program

VICTORIA AXELSSON
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DEPARTMENT OF MECHANICS AND MARITIME SCIENCES

CHALMERS UNIVERSITY OF TECHNOLOGY
Göteborg, Sweden, 2023

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Cover:
Picture taken onboard a bulk vessel traveling on Göta älv, May 2023. By Victoria Axelsson.

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Göteborg, Sweden 2023

PREFACE

This bachelor thesis was conducted during the spring of 2023 by two students studying International Logistics at Chalmers University of Technology. The aim with the International Logistic program is to educate students about the main areas logistics, legal, economics and leadership where maritime logistics are touched upon within most of the education period of three academic years. The bachelor thesis consists of 15 education credits out of the program's 180 education credits.

We are happy to present this study regarding inland waterways, since it was a subject area where our knowledge was limited. Because inland waterways are rarely discussed within the Swedish transport sector, we want to give a special thanks to Björn Garberg at Trafikverket, who helped us get an aroused interest in the subject. We also want to thank all the actors that work with inland waterways that contributed to the interviews. Even though the actors are presented anonymously they contributed incredibly and deserve appreciation for their participation.

Lastly, we want to thank our supervisor Fredrik Olindersson that helped us get an interest in the subject. He has been very supportive from the start until the end of our thesis writing and helpful in many ways.

Cornelia Nilsson & Victoria Axelsson
Chalmers University of Technology
May 2023

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SAMMANDRAG

Länder i Europeiska unionen inklusive Sverige upplever problem kopplade till överbelastade väg- och järnvägsnät till följd av den stora efterfrågan på transporter. På grund av detta har EU prioriterat en utvecklingsstrategi för en övergång från väg- till vattentransport. Anledningen är att minska utsläppen av växthusgaser och minimera trängseln, samt buller i mycket urbaniserade områden. Idag transporteras en låg andel av Sveriges totala transporter på inre vattenvägar trots att Göta älv, Mälaren och Vänern är fullt fungerande. Studien är avgränsad till containersegmentet och för ökade transporter på Göta älv.

Sex intervjuer har genomförts med olika aktörer inom området för transport på inre vattenvägar. Med syfte att överblicka den nuvarande situationen för transport av containrar på Göta älv, som ett möjligt framtida transportmedel. Studien har visat att en ökad användning av inre vattenvägar kan hjälpa till att leda till mer spridda transporter för Sverige. Infrastrukturen för inre vattenvägstransporter finns redan, men det behövs investeringar i superstruktur vilket är en av anledningarna till att containersjöfart inte används på Göta älv. Tack vare de höga kostnaderna för de nödvändiga investeringarna, har detta i sin tur lett till höga avgifter för de aktörerna som vill använda inre vattenvägarna för transport av gods.

Nyckelord: Inre vattenvägar, Transport på Inre vattenvägar, Torrhamn, Aktörer, Göta älv, Transportmedel, Superstruktur, Infrastruktur.

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ABSTRACT

Countries in the European Union including Sweden are experiencing problems connected to strained road and rail networks as a result of the large demand for transport. Because of this the EU has prioritised a developing strategy for a modal shift from road to water transport. Reason being to reduce greenhouse gas emissions and minimise congestion, as well as noise in highly urbanised areas. Today, a low percentage of Sweden's overall transport is transported by inland waterways even though Göta älv, Mälaren and Vänern are functional. The study was limited to the container segment and the abilities for transportation on the river Göta älv.

Six interviews have been conducted with different stakeholders within the field of inland waterway transport (IWT). With the aim to overview the current situation of IWT of containers on Göta älv, as a possible future transport mode. The study has shown that an increased usage of IWT could help lead to more dispersed transportation to spread the prospects for shipping. The infrastructure for increased transportation already exists, but investments in the superstructure are needed which is one of the reasons that container shipping is not used on Göta älv. Due to the high costs of the needed investments, which in turn leads to high fees for the stakeholders wanting to use IWT.

Keywords: Inland waterways, Inland waterway transport, Dry port, Stakeholders, Göta älv, Transportation mode, Superstructure, Infrastructure.

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ACRONYMS AND TERMINOLOGY

EU	The European Union
Hinterland	The land area in a port
IMO	International Maritime Organisation
IWT	Inland waterway transport; is an alternative to transport goods by water, instead of using rail or road. The goods can be transported with barges or smaller vessels, through canals and lakes. The European Commission describes inland waterway transport to have high potential, because of the advantages with safer transports, higher degree of capacity and less emissions.
IWW	Inland waterways; are the geographical area with water, could be a lake, canal, river or a sound.
NAIADES III	An action plan provided by The European Commission to boost the function of inland waterway transport. Doing this with better logistic systems and increased mobility, with special focus with goals within Europe's rivers and canals.
Stakeholders	A stakeholder is a party, group or individual that finds an organisation and their actions of significance. Depending on what type of stakeholder and organisation it is, the interest varies, and the central organisation often tries to please the stakeholders of importance.
Subsidised	Supporting an organisation financially, in order to pay a part of the cost of a service or product the organisation makes.
Superstructure	A structure built on something else and can also be described as surface arrangements that differ from infrastructure, that can not be moved. Instead, the most common superstructure in ports and terminals are cranes, warehouses and terminal buildings.
Supply chain	In terms of the creation and sales of a product, the supply chain is a network of the activities, technology, resources, organisations and individuals.
Urbanisation	The increase of the proportion of people living in cities and towns, which occurs when people move from the countryside to urban areas.

1. INTRODUCTION

European Commission (n.d) describes Inland waterways (IWW) to be used as a fifth transport mode with transporting goods. Inland waterway transport (IWT) is an important transport mode from an European perspective, since it connects hundreds of the regions and cities together. The European Commission (2021) developed a plan called NAIADES III, where the goal is to increase inland transport shortsea by 25 percent by 2030 and 50 percent until 2050. The use of IWW is widely used by countries in western Europe such as Germany, the Netherlands and Belgium. With the goals of increasing IWT within Europe, this results in the countries within Europe to look over their opportunities for an increased use of the transport mode. Sweden as of today, only transport 0.1 percent of all of their transports on IWW on the lakes and rivers of Göta älv, Mälaren and Vänern (CCSNR, 2022). All three are located in significant geographical areas in Sweden surrounded by important industries. One important IWW is Göta älv that is connected to Vänern, which allows for an alternative transport route within west of Sweden.

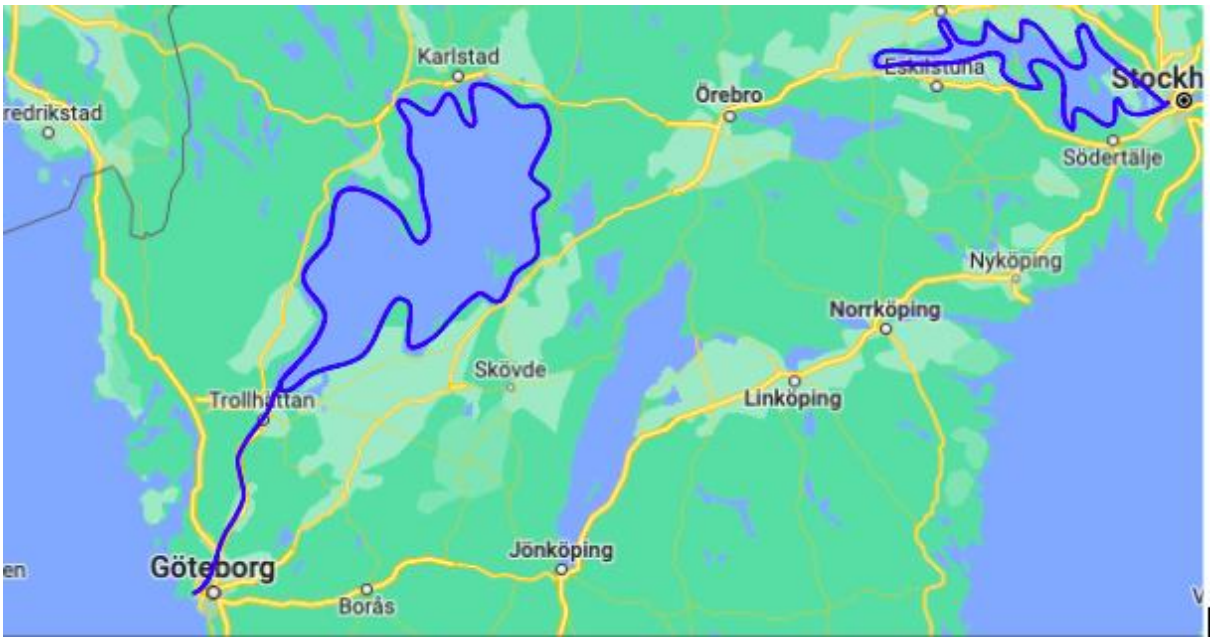

Figure 1: *Google Maps. [Sweden, marked Göta älv, Vänern and Mälaren] Retrieved 2nd of May, 2023.*

Göta älv has been an important transport route for the west of Sweden ever since the 17th century for goods to be transported on Vänern and on Skagerrak. There were problems with the waterfalls in Lilla Edet, Trollhättan and Vargön, which resulted in locks that needed to be built took over 200 years to be finished. Nils Ericsson, Peter Bagge and Governor William Chalmers were a few people in charge of the construction of the locks, the locks were considered to be the world's eighth wonder during this time (Trollhättan Stad, 2021). According to Bergman (2005) the locks needed rebuilding in the early 20th century to be able to transport goods with bigger vessels on the river and foreign vessels then could be transported to Vänern. Today, the river is facing similar problems with the need of the locks being rebuilt to be able to receive even bigger vessels and to be able to meet the standards from the government and the current market. Although the river has been up and running from the 19th century, the amount of the goods, both international and domestic, being transported on IWW are very small, compared to truck and rail.

1.1 Background

Today, the roads in Sweden are highly strained, a result of the large demand for transport by trucks, same for other regions and areas in Europe. Because of this the European Union (EU) prioritised a developing strategy for a shift of transport modes within the sector. The strategy for a modal shift from road to water transport is to reduce greenhouse gas emissions and minimise congestion, as well as noise in highly urbanised areas (Santén et al., 2021). Urbanisation keeps increasing in Europe as well as in Sweden and 88 percent of Swedish citizens live in urban areas as of 2021 (O'Neill, 2023). Since more people keep on moving and living in urban areas, this results in more transports within the big cities. Because of the increased demand for transports, the toxic emissions from the transport sector keeps on coming closer to the citizens (Zacharopoulos & El Rharbi, 2020).

Road as well as rail transportation, are challenged today by congestion and reliability problems (Roso et al., 2020). Therefore, the possibilities for other types of transport could reduce the risks for congestions on Swedish roads. In Sweden the IWW are not being used to their full capacity and by starting to use the transport mode more, it could minimise the congestion problems. The negative aspect is that the IWW can not offer the same flexibility as trucks, which can deliver goods directly from supplier to the customer, door to door. By using the IWW as a part of a transport strategy it could as mentioned above, reduce emissions and congestion. (Santén et al., 2021). One way to incorporate transport on inland waterways is to use it intermodal, as a transport to a dry port. Khaslavskaya & Roso (2020) describes a dry port as by definition, an inland intermodal terminal that is connected by rail to a seaport. The dry port has the same function as a seaport, with activities such as customs clearance, consolidation and storage.

In 2014 the Swedish government implemented the possibility for use of IWW on the Swedish waters. Since the Swedish IWW does not connect to any other countries' waterways, Sweden established its own laws that correspond to the design of the Swedish waters (Silvasti & Svanström, 2021). The use of IWW is considered to be the fifth transport mode within the EU but does not have the same approach in Sweden. Even though the laws for IWT were established in 2014, there has not been an increase of usage, (Silvasti & Svanström, 2021). Sveriges Riksdag (2021) has developed a motion to increase the IWT in Sweden, this can be an intermodal solution for Mälaren, Göta älv and Vänern. With this motion, the actors within the transport sector could help develop the future of transportation of goods in Sweden.

1.1.1 Dry ports in Sweden and the definition

The flow of containerised goods has increased quickly since the 1960´s, this has led to full terminals in seaports that are in need of easing the pressure. A dry port could be used as an additional area for the seaport to be able to maintain a higher capacity and increase their handling ability (Roso et al., 2009).

There is no official definition of a dry port in Sweden. However, according to professors in the subject in Sweden, who have been a part of much research and case studies has concluded for an inland terminal to be defined as a dry port there needs to be an availability of seaport activities within the terminal. The idea is that customers can leave and pick up their cargo in standardised containers within the dry port in such a way that is common in a seaport (Roso et

al., 2009). According to Roso & Khaslavskaya (2020) the most frequently used activities in Swedish dry ports are handling of dangerous goods, transshipments and stuffing. Whilst the less frequently used activities are container consolidation, material control, repacking and relabeling.

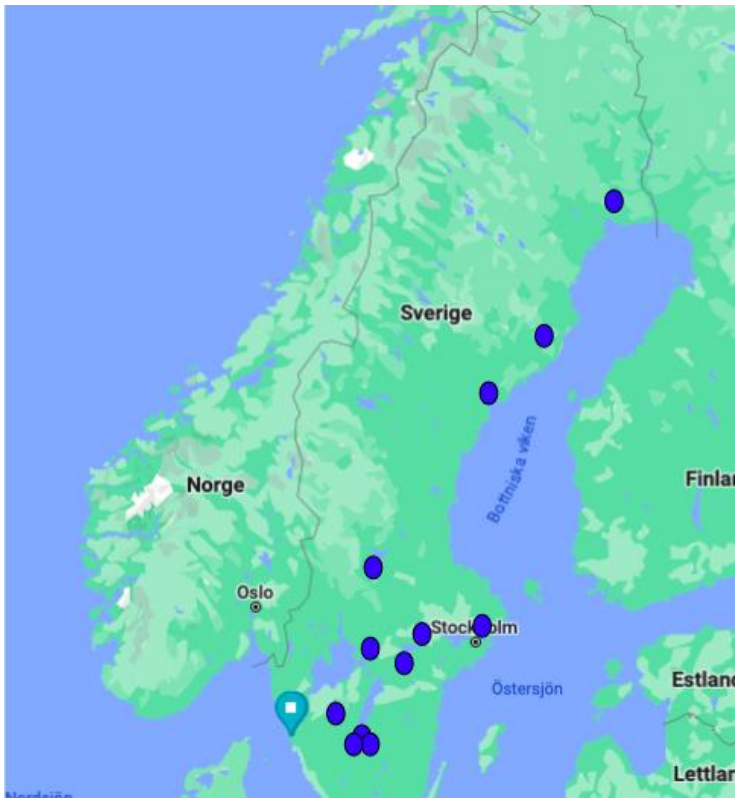

Figure 2: Google Maps. [Sweden, marked the 12 Swedish dry ports and Gothenburg] Retrieved 10th of May, 2023.

The status of dry port development in Sweden today is that as of 2022 there exist twelve dry ports that fulfil the requirements of port activities. The dry ports are dispersed in a big radius all from Vaggeryds terminal in the south to the kombiterminal Gamlestad in the north. The dry ports all have connections with both rail and road, but no connections to inland waterways and therefore need to be used intermodal. Because of the long distance between certain dry ports and seaports, it could be beneficial with new transport solutions (Khaslavskaya & Roso, 2022).

1.2 Aim of the study

The aim of the study is to overview the current situation of inland waterway transports in Sweden and how inland waterways can be connected to other transport modes as a part of the transportation chain. To get stakeholders views on IWT as a possible future transport mode, as to be used on Göta älv. Specifically, how the container segment of IWW in Sweden can be used as a way for an intermodal transport to a dry port.

1.3 Research questions

1. What could an increased usage of inland waterway transport result in when it comes to balancing the flow of transport in Sweden?
2. Why is not inland waterway transport of containers more widely used in Göta älv?
3. What are the stakeholders working within inland waterway transport main concerns?
4. What are the stakeholders opinion with using inland waterway transport intermodal to a dry port?

1.4 Delimitations

Fees connected to certain activities will be discussed, but no financial calculations will be made.

The report mainly focuses on Göta Älv in Sweden and its opportunities but will include some aspects of the other IWW in Sweden such as Mälaren and Vänern.

The background contains a general introduction to the IWT in Sweden, however theory, results and discussion is based on an increased container traffic on Göta älv.

The only freight segments that will be covered in this report are standardised containers such as 20-foot containers and 40-foot containers.

The technical requirements of IWT will not be covered in this study.

The environmental aspect in this report will not cover specific emissions or any calculations.

2. THEORY

Theory will help the reader achieve a greater understanding and better context connected throughout the report. This chapter presents the theory found from the literature of the current situation regarding IWW, IWT, dry ports and container transportation in Sweden.

2.1. Current situation of Inland waterways in Sweden

Today, less than one percent of Sweden's total goods transported are done with IWW, even though it slowly increases year by year (Trafikanalys, 2021). The cargo transported by IWW in Sweden are liquid fuels, mining goods and forestry. According to Sjöfartverket (2020) the Swedish Government has ambitions to promote a transfer from road to the waterways, which they plan to do with beneficial fees for shippers using IWW. The Swedish IWW has the benefit of being able to transport big amounts of cargo with small and frequent shipments, whereas transportation with trucks or rail could result in high risks. The close vicinity of rail and trucks to civilians creates a higher risk than compared to the IWT since there is no close or frequent traffic. Another risk with transportation with trucks or rail, could be the transshipment of dangerous goods along with environmental risks (Sjöfartsverket, 2020).

The option of transferring the risk from road and rail transportation could be partly transferred to Göta älv. Göta älv is fit for transporting goods since it is a 93 kilometres river that extends from the lake in Vänern and to Skagerrak close to Gothenburg with a depth that varies between 6.3 metres up to 20 metres in depth (Statens Geotekniska Institut, 2011). Sjöfartsverket (2021) describes the development and the new construction of the locks in Göta Älv. All the locks are rebuilt to allow the continuing of inland waterway transport and should be financed and the reconstruction should be ongoing by 2030. The new rebuilded locks will be constructed to allow container vessels and for an overall increase of inland waterway transport in the river. The capacity for transportation in the inland waterways are high and the costs for the vessels will be low (Sveriges Riksdag, 2021).

2.2 IWW vessels and IMO vessels

There are two different classified types of vessels that can operate on the IWW in Sweden. IWW vessels are regulated according to Swedish rules and IMO vessels are regulated according to international rules and regulations. The main difference between the two different classified vessels are the vessel construction and the hull. There also are differences in the requirements regarding fire safety and safety equipment, since the IWW are safer to traffic than out at sea. This is because of the close vicinity to land (Sjöfartsverket, 2019).

IWW classified vessels are only allowed to traffic and transport goods on the IWW within Sweden, where the wave heights are low. The standard IMO vessels, which are constructed to be able to transport goods at sea, are also allowed on the IWW (Transportstyrelsen, 2022). The IWW vessels go under the rules of the regulating authority Transportsstyrelsen (TSFS, 2018:60). Transportstyrelsen are governed by the Swedish government in allowance with the infrastructure department (Transportstyrelsen, 2022).

2.3 Other domestic transport modes

Sweden's road and rail network is well developed and widespread. This makes it possible for cargo to be transported across the country all the way from the north, to the south and west, to east of Sweden. There is a slight difference in the opportunities between the two transport modes since the road system has a slightly wider reach (Jonsson et al., 2019). Rail and road transport is the most frequently used modes of transport in Sweden. As an effect of the frequency there are parts of Sweden's rail and road system that are very strained (Sjöfartsverket, 2021). According to official statistics from Trafikanalys (2023) domestic trucks transported 471 565 000 tons of goods during 2022. The statistics for domestic rail transport 2022 was 71 516 000 tons of goods (Trafikanalys, 2023).

2.3.1 Rail transport

Transport by train has the capability of being able to connect to multiple wagons, rail transport has the ability to transport a high volume of goods at one time. Rail is a good option for customers that have big volumes and rail can handle both short and long distances. However, according to (Jonsson et al., 2019) rail transport is most optimal for long distance transports, since it is more profitable. Rail transport mostly entails movement between two or more terminals and very rarely directly to the customer. The departure frequency is lower than compared to road since multiple trains use the same rail network and there is a need for a set schedule and timetable. There are also difficulties tied to there being more cargo owners involved which makes flexibility in departure times difficult to uphold. Whilst trucks can depart when it has been loaded and does not have to wait, there is a different experience with rail where multiple units risk being late (Jonsson et al., 2019).

The emissions from rail transport is considered one of the lowest in comparison to other transport modes, since the Swedish rail network runs on electricity (Trafikverket, 2020). There are however possibilities of indirect emissions connected to the production of the used electricity (Jonsson et al., 2019). Today, rail transports are being affected by the lack of train drivers (Höök, 2021). Which can lead to the lead times becoming longer and delays can occur.

2.3.2 Road transport

Road transport in Sweden by trucks is the most usual transport mode in Sweden for both short and long-distance transports (Jonsson et al., 2019). It is also the most flexible transport mode since it can offer door-to-door delivery for customers. This can make the lead times shorter compared to rail since the transport does not need to be handled more than once during loading and unloading of the unit. It also makes the departure times able to be flexible considering there is usually only one cargo owner involved. As soon as the cargo is loaded onto the truck, it can depart and do not have to wait for a specific time.

The main disadvantage for road transport is the maximum limit on the length of a modular system of 25.25 metres, that puts a limit on how much cargo the truck can transport (Transportstyrelsen, 2021). It is one of the transport modes that lead to the most emissions. The environmental impact is not only in the form of emissions but also noise that can affect the local environment and congestion in the cities especially during rush hour (Jonsson et al., 2019).

Another problem the road transport sector is experiencing, is the lack of drivers (Bederoff, 2023).

2.4 The use of dry ports

According to Notteboom et al., (2022) a dry port is created to solve one of two problems. Firstly, it could be that a seaport's capacity is being filled and there is a need to transport empty containers or containers that are waiting for their owner to another place outside of the port grounds. This is called outside-in dry port development and means that the hinterland logistics development is port driven. The other way for a dry port to exist is if there is another party that potentially would benefit from having a port geographically closer to them. One reason could be that there is a need to transport a large amount of cargo from inland Sweden to the port in a way to balance import and export. This is called inside-out dry port development and means that the hinterland logistics development is driven by the public or private sector. It is also possible that the development of a dry port can be mutually beneficial for more than one party.

The development of a new dry port has the ability to trigger the development of the chosen region, since the proximity of a dry port will attract new businesses that are in need of a logistical solution (Khaslavskaya & Roso, 2022).

2.5 Container segment in Sweden

Wickenberg (2023) describes that the container segment in Sweden has increased year by year in recent years. The Port of Gothenburg has increased their market share, during 2022 their container volume by seven percent and 885000 TEU of containers were handled. According to Göteborgs Hamn (2023) 53 percent of the Swedish container traffic is handled in the port of Gothenburg and is the biggest port in Scandinavia. As of the beginning of 2023, there has been a decline of containers handled in Sweden, due to the economic situation (Wickenberg, 2023). Even though the economic situation and there are tendencies for a recession, the container segment still has a big importance regarding the country's export and import of goods (Göteborgs Hamn, 2023).

The container flow in and out through the Port of Gothenburg is today being transported by train and truck. Göta älv is close to the port of Gothenburg and there are no continuous activities with vessels transporting containers through IWW to Vänern or other close cities around the river. (Santén et al., 2021). However, there has been a project called the EMMA-project that experimented with a container barge in 2016 between the Port of Gothenburg and the Port of Vänersborg. The goal with the EMMA-project was to demonstrate the potential of taking the next step regarding IWT in the Baltic Sea Region where Sweden was a part of the project. The results from the experiment on Göta älv shows that there was a possibility to transport containers on the river.

2.6 Stakeholders in IWT

Transportation through IWW requires coordination from several stakeholders for transportation from one point to another. Williamsson et al. (2020) describes goods owners with large volumes could be ideal stakeholders within IWT. If the goods owners decide to move a small amount of their goods on IWT, this results in a low impact and risk to their supply chain. For the goods to

be transported, there is a need for a ship and a shipowner to deal with the operation of the vessel for chartering on IWW, which are considered being an important stakeholder. Freight forwarders are considered an important stakeholder within IWT, since they can take advantage of the bigger volumes transported on IWT compared to a truck. If the freight forwarders can book transports with larger volumes, this could result in lowering the prices for IWT and a better profit for the freight forwarder (Williamsson et al., 2020). The Swedish government and authorities on a regional and national level are highlighted to be stakeholders within IWT in Sweden. By reason of the IWT being regulated under the Swedish IWW-rules, the Swedish authorities control and work along with the laws set by the Swedish government (Sjöfartsverket, 2020). Terminal operators and ports are considered stakeholders to IWW since IWT is only possible in intermodal transshipments and that is requiring the need of a port or terminal to reload.

3. METHODS

This chapter presents the chosen research methods to gather the relevant data and further on being analysed for the study. To collect the data, a method combination of interviews and literature is chosen. Denscombe (2013) describes using a combination of methods gives an increased accuracy, since the results from one method can combine with results from the other method. Further on, it gives a more complete picture of the situation and the ability to develop the analysis additionally. The interviews will be of qualitative data to get the interviewee's point of view of IWT, since it opens up for an interacted and analysed session (Kvale & Brinkmann, 2014). The literature will be of qualitative and quantitative data, the qualitative data contain official statistics from IWT and the quantitative data from literature regarding IWT. According to Denscombe (2013) a method of using both qualitative and quantitative data can bring more complexity and can simultaneously be used on different levels throughout the research.

3.1 Interviews

The study will be used with qualitative data from semi-structured interviews, which are the main data collection source for this report. The actors that will be a part of the semi-structured interviews are experts in the fields of transportation and inland waterways in Sweden. The actors considered in the interview are both from the public and private sector that have experience and knowledge within IWT. The six interviewees are actors such as maritime logistics researcher, CEO of a maritime shipping company, CEO of a logistics company, terminal manager, Market manager at a Swedish port and a manager of the business area cargo in Swedish Port.

The reason for the decision of semi-structured interviews is that it makes it possible for a deeper dialogue and questions might arise during the interview. Semi-structured interviews give the participants the opportunity to speak more openly and stress the issues that matter for them (Kvale & Brinkmann, 2019). According to Denscombe (2013) could semi-structured let the person being interviewed develop ideas and be more flexible along with their answers.

According to Kvale & Brinkmann (2019) the interviews should be planned and performed in seven phases. The first phase, "thematizing", formulates the purpose and the idea of the subject before the interviews begin. The second phase is "planning" the arrangement of the interviews, where questions will be based on the knowledge that needs to be learned regarding inland waterways and dry ports in Sweden. The third step is the performing of the interviews and further on the results will be documented in writing. There, the results will be analysed and verified for validity and reliability. The last step is to note the results into the report for discussion and conclusions.

The interviews that are held will be followed by standard questions developed for answering the research questions regarding IWT.

Semi-structured interview questions
1. Background question - who are you and in what ways have you worked within the area?
2. What advantages do you see in the Swedish IWW and are there any differences between the different ones?
3. Who is responsible for what between the actors?
4. What do you think the future of IWW in Sweden will be like?
5. If this is going to work in Sweden, what is your opinion on today's infrastructure?
6. Do you think anything else needs to change for container IWT to be possible on Göta älv?
7. Would it benefit the IWW-sector to have an intermodal transport to a dry port and why?

Table 1: General questions asked during the interviews.

Depending on the answers from the actors being interviewed and their views on IWT, different following questions can be openly asked during the interview. Because of the choice of semi-structured interviews, the questions are allowed to be open and have different views on IWT (Denscombe, 2013). The interviews will be done face-to-face or through video, since this can result in more detailed and more information regarding the questions asked (Kvale & Brinkmann, 2019).

3.2 Literature

Data will be collected from different sources such as books, websites, official statistics and scientific reports. Those are chosen due to the relevance of the report, with information regarding inland waterways, transportation and dry ports in Sweden. This has importance for the validity in the thesis.

Through using scientific databases such as Scopus, ScienceDirect and Google Scholar different scientific articles and journals were found due to the relevancy of the research. Keywords such as *Inland Waterway Transport, Inland Waterways Sweden, Dry ports Sweden, Intermodal transport* and *Stakeholders Inland Waterways* were used widely to find the significant literature of the fields of inland waterway transport in Sweden. Using keywords gives a better accuracy of finding relevant articles and journals that further on can be used in the research (Denscombe, 2013).

Project reports, websites and other non-academic reports were gathered from the scientific reports and from the interviewees as qualitative data. The report and websites were used in the report depending on reliability and authenticity regarding IWT in Sweden. Denscombe (2013) describes the evaluation of sources to be done with the aspects of who the editor is, when it was created, what role the editor has, if the title has a national determination or if it is reviewed by aspects.

Statistics from Trafikanalys, which is a government agency, provided for knowledge of the government within transport politics in Sweden will be used in this report. Denscombe (2013) defines statistics as quantitative data, which will be analysed for an overview of the transport sector.

3.3 Ethical aspects

Ethics is a central aspect regarding data collection performing video- and face-to-face interviews. Bhandari (2021) describes the importance of adhering to a code of conduct while doing research to protect the rights of the participants, maintain academic or scientific integrity and raise research validity. It is important not to do any harm to the participants, which is the reason to keep the interviewees in the research anonymous.

4. RESULTS

This chapter presents the result from the study performed with interviews of relevant actors within IWT in Sweden.

Aspects	Summarised answers from interviews
Problematic aspects with IWW	• High pilot fees • Lack in superstructure • Lack of knowledge, especially with authorities • Sweden's regulations • Import volumes
Responsibilities	• Fingerpointing, but overall responsibility lies with the Swedish government • Freight forwarders view
Opportunities	• A more balanced transport sector in Sweden • Economies of scale • Crisis preparedness in Sweden • Green shipping
Future development of IWT	• Slow change as of today • Regulations and fees need evaluation

Table 2: Results summarised from the interviews.

4.1 Interview A- Maritime logistics researcher

Interviewee A found the implementation of IWT to have its opportunities, but there are a lot of obstacles to make it productive and profitable. When asked about the different advantages of IWW in Sweden, she stated that IWT can develop into an economy of scale and transport higher volumes than compared to transportation by truck and railway, which is also something the Swedish government wants to invest in. She also stated the opportunity to spread the risk of transportation modes in Sweden. The reason why it is good to spread the risk is because Sweden is highly dependent today on transportation by road and rail.

There have been a few experiments on IWW but one on Göta älv which is called the Emma project, according to interviewee A. The problem with these kinds of experiments is that additional costs can arise that were not calculated from the start. Another problem is that the freight forwarders will not get the same profit margin compared to using train or rail. Especially since freight forwarders get high profit margins from trucks and even rail since it is highly subsidised by the Swedish state to make it profitable for actors in the sector.

She stated that the biggest problem is to get the volumes for the import of goods, whereas export is not a problem today. She also explains the problematic with the Swedish regulations for the vessels operating on IWW. The reason why the Swedish regulations are problematic is because there are different regulations for vessels operating on IWW and different regulations for vessels that are on the international oceans which makes it hard to draw the line. However, she did say that there are big opportunities with IWT, but it all starts with getting

big enough volumes and to get more people invested. Something to have in mind is that multiple steps need to be taken with IWT, because of the transportation from a international ocean-going vessel needs to do one move to a terminal, later on a move to a barge/ship for IWT, then another move to another terminal and then on to another transport mode.

Her belief is that the use of intermodal transport to a dry port is not of interest until the container transport on Göta älv is functioning. She finished off the interview by saying that the IWW could be a step towards a green shipping industry, but it all depends on the main international ocean-going shipping companies. She also explains that there needs to be more done on the industry-side to get the volumes up and invest in this transport mode.

4.2 Interview B- CEO of a logistics company

Interviewee B believes that what is needed at this point to start container lines on Göta älv is better regulations, regulating IWT. When asked why the development of IWT regulations has been slow he states that the authorities have lacked an interest in cooperating and problem solving regarding IWT. Although he believes that there is not an unwillingness to change but instead the reason is that people involved do not have the knowledge and the expertise needed when it comes to creating rules and regulations regarding IWW and IWT.

He also criticises the way authorities and Sweden as a whole favoritise transport on rail and how much the Swedish rail network is subsidised each year. Especially since the government has stated an ambition to increase transportation on IWW to ease the strain on the Swedish roads and rail network. He used an example of Vänerexpressen which is a train shuttle from Karlstad that he believes is not promoting more use of IWW, since the ports using the train shuttle are in Vänern which in turn is connected to Göta älv.

He sees a problem with starting a container transport line on Göta älv regarding transporting multiple cargo owners at a time and the problems that can arise. The main difficulties are finding a balanced flow of customers and goods over time and in both directions on Göta älv. He sees positively on partnership and expresses the need of main partners that will stand for the majority of the costs and investments, since smaller parties will not be able to cover the costs in the beginning before the flow is up to a feasible amount. He mentioned different port organisations as examples of main partners that he would like to see invest in the matter. It is in his opinion that the infrastructure for the IWT already exists and is up to par in Sweden when it comes to depth and accessibility for traffic. However, investments are needed for superstructure in quays such as cranes, that will make it possible for full containers to be loaded and unloaded onto vessels.

He sees the importance of IWW for Sweden's crisis preparedness and the accessibility in other transport modes in case of any attack on Swedish infrastructures such as the rail network. He also mentioned, connected to the crisis preparedness, that there are not many vessels that are registered under the Swedish flag state. He connected the issue to the not so benefiting fees from Sjöfartverket, which in the end can lead to Swedish military not having access to enough tonnage and vessels when faced with any threats.

4.3 Interview C- CEO of a maritime shipping company

Interviewee C starts up the interview by explaining the problems with IWT. Today it is hard to find a balance of the goods transported, the reason why it is hard to find a balance is

because the goods transported are in the hands of the freight forwarders. He also explains the problem of the Swedish railway system and how highly subsidised it is by the Swedish state. The freight companies do not need to pay for the infrastructure nor the maintenance of the rail. Even though the railway has been contributed with loads of money, it is still the least economical transport mode in Sweden and is stately owned.

Interviewee C explains that the port of Gothenburg's vision is only to get railway pendulum in, that they focus on railway as the main transport mode. Whilst the infrastructure for IWT is already there. The only work that needs to be done is the reconstruction and development of the locks in Göta älv, but as he explains they are there for over 100 years which means a low environmental impact and cost divided on the amount of years.

He explains that the Swedish government is subsidising the rebuilding of the locks in Göta älv and wants to promote the IWT. However, the contribution from the Swedish government is too low to be able to increase the IWT and make it profitable for the stakeholders. Interviewee C also talks about how hard it is to find people that have knowledge within IWT and needs to work uphill to even operate on the IWW. This results in that they can not just buy a ship for IWT and “hope” that Trafikverket will flag it in time. Since everything with IWT takes a long time which costs too much money for the companies dedicated. He finds it hard to see how this will be done in a sensible way when the contribution and help from the government is not enough as of today.

The regulations in Sweden are also a big problem, according to interviewee C. Because IWW-vessels (including barges) need to be operating in an IWW-area, it means that they get “locked in” in that specific area and can not be used in other areas. This results in no one wanting to build IWW-vessels for the Swedish regulations that can not even be sold to another country internationally for their operation. When speaking about the pilot fees, he did find them expensive but not to be the biggest problem, since it is harder to find pilots for the entire transportation route. He explains that just to “stand by" waiting with a ship for available pilots that can take days is more expensive compared to the fee while operating.

But he finished off by saying that it is hard to see the future of increased transportation by IWW until there will be imperative laws from the Swedish Armed forces. If they start commanding the availability for transportation by IWW, which they can not use today, this could make the Swedish government change the laws with IWW vessels and could open for more transportation on Göta älv.

4.4 Interview D- Market manager at a Swedish port

Interviewee D communicates that the main issue that they, as an organisation, see in the change towards more IWT is the pilot fees and other additional fees. As a company the need for profitability is crucial and he believes that the different fees are making it difficult to achieve. In his view other actors within IWT seem to think that inland ports and terminals should lower their handling fees to promote the use of IWW.

Inland ports have costs that need to be matched with the fees and big investments in new superstructure in the form of cranes to be able to perform certain services. They see positively on container traffic on Göta älv in the future. The belief is that they will be able to make space for container handling. However, he has a difficulty seeing that it will be ports and terminals making the big investments before there are already functioning transport lines that

determines it to be a profitable business. He believes that the government needs to make a contribution to really make a difference since the smaller stakeholders are not able to make the big investments that are needed. As most interviewees he agrees that it would be beneficial for Sweden's crisis preparedness to have working transport on IWW and experienced actors.

4.5 Interview E- Terminal manager

Interviewee E said, as a transshipment terminal they were very positive towards IWT in terms of starting to use another transport mode as an additional alternative. They were also very interested in the IWW since the ability to move cargo on the water will create benefits for them as an organisation but also to their customers and their region. Since they as a transshipment terminal have opportunities to transport cargo on road, rail and IWW they consider their terminal to be a future place as a transshipment hub for more IWT.

It is in his view that the main and most important investments that are needed for container transport on Göta älv is superstructure. For now, they as a terminal do not have the ability to handle a large amount of fully loaded containers. For it to be a successful venture, there is a need for investments in additional equipment such as cranes for container handling. As a terminal with access to the Swedish rail network, he did not see a need to use another transport mode but was also not extremely against the possibility in the future.

He said that they have been involved in many projects regarding IWW, because the terminal wants to be involved in a change for a better future. For example, the Emma-project that experimented moving containers on IWW. Another point he brought up was that they as a company see that development of IWT is important for Sweden's crisis preparedness, since both road and rail transport networks can be a target. Which is the reason why it could be good to spread the risk with as many transport modes as possible.

4.6 Interview F- Manager of the business area cargo in a Swedish port

Interviewee F describes the port as having good rail connections to the whole of Sweden. The majority of their transports from their port goes by rail and the rest by truck. The port works today as a spoke port, which means that they rarely work with transshipments. Since an increased use of IWT would result in more transshipments, they see it as outside of their scope. He describes the economic aspect as the most important issue with the development of IWT. The price of handling containers is not able to be lowered by the port operator to benefit the use of IWW. They believe the responsibility for extended use of IWW is not on the port, but the government to contribute with financial subventions. As of today, they have not seen actions from the government that shows an investment of increasing IWT.

The capacity in the container terminal is not a problem according to interviewee F. He does not agree with other actors that areas around Göta älv have a strain on the road and rail network. At this time, they have no interest in IWT and as an organisation they do not have conversations regarding this matter. The reason for this, is because they do not see the market perspective to be profitable with using IWT, when rail and road is so established in Sweden. IWW was not a transport mode of interest to a dry port since the port has access directly by rail.

5. DISCUSSION

In this chapter the theory and the results of the interviews will be discussed. In a way to compare the results of the different interviews with each other and with the literature in the theory to come to a conclusion and the reliability factor.

5.1 The government's responsibility

Speaking to the different stakeholders, they all agree that despite the Swedish government's motions towards the extended use of the IWW there is no sign of true ambition from their side. The image the government presents of their ambition, is that there are no clear goals and actions to the actors within IWT. Actions that would be considered from the stakeholder's point of view as beneficial and moving in the right direction is lowering pilot fees, financial contribution towards new superstructure and container handling in terminals, as can be seen in Table 2. The question is if the responsibility for these actions should lie on the government since the motion was created by their initiative. Because of the small number of actors in the IWT, the government could help by promoting those working in this segment. The experience of the stakeholders is that they are all small actors and are not themselves able to make the big investments. Reason being that the flow of goods needs to be balanced and in the beginning of a business it might be hard to achieve a high volume of goods. The issue lies with making it interesting for multiple cargo owners to change their existing transport strategy and therefore achieving a profitable volume for the charterer. Which would in extension lead to a larger volume of transported goods on IWW compared to the low percentage that is today (Trafikanalys, 2021).

Since the European Commission (2021) has concrete future goals for IWW in NAIADES III and they are a decision-making organisation, it would be beneficial for all member states to have the same ambitions. As mentioned above, Sweden does not have concrete future goals within IWT even though they are a part of the EU. The organisation could put pressure on the Swedish elected officials to make sure there will be a difference in the number of goals and actions within IWT. If the EU put pressure on Sweden, it could lead to a more diverse transport sector on Göta älv and the rest of the Swedish IWW.

5.2 Infrastructure and superstructure

The infrastructure within Göta älv is considered acceptable for IWT by the interviewee B. Whereas interviewees A, C, D and E thought that with a little bit of maintenance work could be suitable for active traffic. The reason why it is acceptable is because the river fulfils the demands on depth, which makes it possible to operate a vessel.

One investment that needs to be made for the ability to keep transportation on IWW going is the restoration of the locks along Göta älv. This is a big investment that will cost the government billions of SEK but will result in the locks standing for another 100 years (Sjöfartsverket, 2021). When discussing the costs of investments and maintaining IWT compared to the rail network with interviewees B and C, they believe that when divided per year, IWT costs are lower than the maintenance of the rail network. This makes the investment of new locks not necessarily more costly compared to the yearly maintenance of the rail network.

The results from interview A, B and C shows that the rail network is highly subsidised and costs a lot of money every year for maintenance and has a hard time making it profitable. As

the interviews state the infrastructure is already there, but the problem is more connected to the superstructure. Having the ability to load and unload containers on a vessel requires cranes that can carry heavy containers. As of today, there is only one port in Vänern that has the possibility to move containers from water to land which is Kristinehamn. For container transport to happen on IWW along Göta älv and Vänern, there needs to be a demand. This will require more cranes for load and unloading which is an expensive investment. When discussing the most profitable transport mode with the interviewees A, B and C, they considered IWT to be more profitable if the volumes are high enough on each transport.

When the stakeholders got the question about the possibility for an intermodal transport with IWW to a dry port, the common opinion is that it is not applicable until IWT with containers is functional on Göta älv. In theory it would result in more transport on Göta älv, however there are other problems to account for first. The current situation means that the stakeholders did not see the service as a solution towards more container traffic on IWW until there is a superstructure for container handling.

5.3 Competitors of the IWT and possible partnerships

The competitors with IWT are rail and road transport, but since it is a small segment on the Swedish market it is not likely to be competitive and take up a big percent of the total transported goods in Sweden if successful. Instead of seeing it as a competitor, it can be seen as a solution for balancing the domestic transports, relieving the congestion and helping the lack of truck and train drivers in Sweden (Höök, 2021; Bederoff, 2023). There are multiple risks of transportation near urbanised areas, especially with dangerous goods (Sjöfartsverket, 2020). These types of transports could with advantage be transferred from road and rail to IWW. Reason being that the dangerous goods could for instance be poisonous, explosive and environmentally hazardous. There could also be problems with transshipments, handling and stowage of different types of cargo on all transport modes. If the cargo is incorrectly handled, it can lead to multiple different dangerous effects on both civilians and the environment in the area. Therefore, the modal shift of specialised goods to IWW could minimise some of the risks with transportation today (Sjöfartsverket, 2020).

Interviewee B described how in conversations with a producing company in the West of Sweden were able to come to an agreement about export shipments on Göta Älv. The producing company could guarantee that the vessels would be loaded to full capacity, and this would mean good profitability for both parties. However, the interviewee found difficulties on the import side since having more than one cargo owner on one vessel made planning and stowage problematic. It is considered problematic hence to all cargo owners having individual interests and needs for their transportation chain. One solution mentioned in the interviews, is creating a partnership between the charterer and the cargo owners. A partnership could benefit the cargo owner getting a lower price for transportation per container and at the same time get more use of the capacity on the vessel for the charterer.

Freight forwarders are described in the interviews as negative towards IWT which is a part of the economic aspects. Since their profit margin easily can be affected with changing transport modes, it can have an effect on their participation. When the capacity can be filled, the profit margin for the freight forwarder is considered good in comparison to rail and road (Williamsson, et al., 2020). Considering today's market on IWW the likelihood of all the transports to be full is very slim and their profit margin on IWT is usually low. Which could be a reason for the lack of interest by the freight forwarders for IWT since they are more

likely to have a higher profit margin with transport by rail and truck. Reason being rail and road well established and concurring the Swedish domestic transports compared to the low margin on IWW (Trafikanalys, 2021).

5.4 Awareness of IWT

There is a need to raise the awareness of actors within the transportation sector. Some of the interviewees found it hard to proceed with their work regarding IWT. Because a lot of people working with the administration in the national regulating agencies such as Sjöfartsverket, Transportstyrelsen and Trafikverket are considered having a lack of knowledge regarding IWT. This means that every decision and every step to make IWT a more plausible option takes a long time. When things take a long time, this could result in the actors getting tired of being an active part of the change in the transport sector. One aspect of the lack of knowledge is the classification of an operating vessel to be an IWW-vessel or an IMO-vessel. The problematic with the IWW-vessels is that they are strictly bound by the Swedish rule by Transportstyrelsen TSFS (2018:60) for operations on the Swedish inland waters and can not be operated out at sea. This results in actors having to use IMO-vessels since the current market for Swedish IWT is not strong enough for the actors to support themselves by only transporting goods on Swedish waters.

The results from the interviews state that even though the roads today are strained, the actors do not see a change in an increased use of IWT any time soon. The reason why is because the truck- and rail network works as well as it does today. The decision of a higher degree of crisis preparedness could however change the view from stakeholders within the transport segment. Something all the interviews had in common was the connection between the IWT and crisis preparedness of Sweden. Since the country relies heavily on the rail network to function, it can become a target when a foreign power wants to have an impact on the country's ability to supply Sweden's population with necessities.

5.5 Method discussion

The main data collected was from the semi-structured interviews, where six interviews were conducted out of the ten actors asked. The interviews were anonymous due to keeping the participants in the interview to prevent them from any harm that could occur. The interviews were performed with six different actors within IWT to get a broad view of their opinions. All the interviews were out of a quantitative research approach and performed face-to-face. The reason why, was to get the interviewees responses and reactions under the specific moment they were interviewed (Kvale & Brinkmann, 2019). After the six interviews with the different stakeholders within IWT, the conclusion was made that the responses were saturated. The responses being saturated could mean that the responses have a high reliability, since they indicate the same answers with some variation. The study could be considered being very narrowed which could be a disadvantage because the study only focused on their view on container transports on Göta Älv. Further on, if more stakeholders within IWT would have been interviewed, this could have concluded in a different outcome.

The questions, as can be seen in Table 1, asked during the interviews, were formulated to be as objective and natural as possible. Reasons being not to affect the interviewees responses in any direction regarding the subject (Denscombe, 2013). The interviews being semi-structured, made the participants' answers more nuanced, however this interview technique takes a longer

time for every interview compared to other methods. Since every interview took a long time to complete, meant that the time was limited to only proceed with a few interviews.

The order the interviews were held could have had some effect on how the study proceeded. However, this was not an aspect that was contemplated before the interviews, but considering the different stakeholders views and their recommendations for further interviewees could have led the study differently. The outcome of the results would have been the same, but the execution of the report could have led to other aspects being considered, since the interviewees had slightly different attitudes to the subject. If the first interview would have been with a stakeholder that saw less positivity on the IWT development, it could have meant that the report changed direction towards other transport modes.

The aim with the chosen literature was with scientific reports and other reports regarding IWT was to get a broader understanding in the subject. The reports were chosen due to the closeness of the subject and their specific publication date, due to their relevance. The project reports, websites and other non-academic reports were chosen depending on the person or organisation writing the content. The reliability of the written content could be discussed, due to them not being scientifically reviewed. However, depending on the written content corresponding to other similar sources, the conclusion was made to be reliable.

The statistics that were used was quantitative data, which could bring an improved insight regarding the transport sector. These statistics are from Trafikanalys, which are Sweden's official statistics regarding all the transport modes in the country. Since the statistics are provided by an authority that represents official statistics from Sweden, it could be reliable.

The conclusion is that the chosen method of using interviews as the main data collection and other relevant literature was successful, provided a reliable and validated result. Reason being, that stakeholders chosen to participate in the interviews are from different sectors regarding IWW. Some of the stakeholders shared opinions regarding certain areas, which resulted in a clearer result in context to the study. The areas where the stakeholders did not share the opinion, it was important to study their individual biases, supported with relevant literature to make a validated conclusion.

6. CONCLUSION

The aim of the study was to get an understanding of the current situation on IWT on Göta älv and get stakeholders opinions within the subject.

The results from the interviews showed that by extending the use of IWW could help balance a part of the flow of transported goods in Sweden. Leading to a more dispersed transport sector but where the IWT is not considered a big competitor to the other domestic transport modes. Reason being the volumes of goods that could be transported on Göta älv, can not reach the volumes that are transported by rail and truck in Sweden. This will result in less congestion in urbanised areas and minimise the overload of trucks on the Swedish roads. The rail as of today, is facing similar problems with strained rail tracks and a need for relief. The opportunity by having a fifth transport mode, could be helpful in a case of a national crisis. All the interviewees shared the opinion that it is necessary for Sweden to spread the risks by having multiple transport options in case of an unpredictable event.

The reason why IWT is not widely used in the container segment is because of the high fees of using the IWW. The high fees of using the Swedish IWW prevents the stakeholders within IWT from making a profit and for new actors to get involved. The superstructure along Göta älv and Vänern is not as of today suited for container handling. The interviews came to the same results of big investments being needed, but no stakeholder within IWT has the financial ability to invest. Some of the stakeholders see the solution being that the government has to go in with the investments for the superstructure. The stakeholders found the concept of using IWW to transport containers to a dry port intriguing. But until the superstructure is workable there is no interest in creating an intermodal system for transportation of containers.

The main concerns of the stakeholders are the high and compulsory pilot fees. There has also been experiences of long waiting times connected to lack of pilots, which could lead to additional cost. Further on, the knowledge of IWT in the transport sector is considered a problem when asking the stakeholders. The experience is when working with regulation authorities, that the authorities do not have the proper knowledge of the operations to make decisions for an extended use of the Swedish IWW.

6.1 Recommendations for further research

An interesting aspect within the subject area of IWW and IWT but was not covered in this report is the environmental impact. There are many different aspects to environmental impact and calculations that can be done for a greater understanding. By comparing the effect both short term and long term for the different domestic transport modes in Sweden and when they are used intermodal. The results could be helpful for further arguments for an increased use of IWT.

One aspect that was only slightly covered in this report, but an important result. Were the pilot fees that have been deemed a big problem for the extended use of IWT. By getting a more detailed overview of the different fees that are connected to transportation on IWW, could result in a better understanding of the problem of IWT in Sweden.

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