TOWARDS AUTOMATION IN PORTS; THE INFLUENCE ON SAFETY CULTURE.

Master's thesis in Maritime Management

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Abstract

It is essential to understand that the increasing expansion of global trade and globalisation of the world economy lead to an increasing use of equipment in the maritime industry which raised the need for automation in port operation.

In this master thesis the qualitative and quantitative approaches are combined in mixed method and triangulation. The data are both primary in the form of interviews, questionnaires and observations, which are presented in the result and analysis chapter and secondary, in the form of literature review analysis.

The purpose of this master thesis is to explore the influence of automation on safety management culture used in Ro-Ro shipping ports by a liner shipping company. Linked to this purpose, this thesis aims to address the impacts of further implementation of automation in reputation and economic indicators for the liner shipping company, which will have further effects in economic and social sustainability of the company.

To succeed this, a further implementation of automation in liner shipping companies will occur in a possible need of a structured Safety Management System (SMS) and proactive risk assessment process to maintain the company’s efficiency and employees’ safety. The results highlight that these safety measures would not only boost employees' spirit and motivation, but also would be positive to the company's reputation and overall performance. As liner shipping companies move towards transforming their operations to automation, it is important to implement a consolidated SMS and proactive risk assessment process to increase safety, efficiency, productivity, and economic sustainability. The connection among safety, automation and social sustainability indicated the importance of involving the employees in the transformation journey.

Key words: Liner Shipping Company, Trailer Operations, Ro-Ro port, Port Operations, Safety Culture, Safety Management Systems, Risk Assessment, Automation, Social Sustainability, Economic Sustainability

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Ro-Ro – *Roll-on/Roll-off*

SMS - *Safety Management System*

IT - *Information Technology*

ICT - *Information and Communication Technology*

SLR - Systematic *Literature Review*

HSQE - *Health, Safety, Quality & Environment Manager*

1. Introduction

In the introduction chapter the reader is introduced to the topic, while the background, research questions, purpose and delimitation are presented.

1.1 Background

Global trade of products and passengers by sea transport has increased the last twenty years (ITC, 2020) even though the global tensions remain (WTO, 2020). In order to follow the expansion of the global trade and the globalisation of the world economy, the maritime industry increased the use of containers and trailers to satisfy the rising demand (Cullinane et al., 2006). According to Conca et al (2018), the tripled expansion of capacity and volume in the world's cargo containers during the last decade is an outcome of the development of the shipping industry stemming from the need for advanced handling facilities due to the increasing world trade. Kemp (2015) supports that among other factors environmental and economic factors lead to the development of mega carriers in the last years by maximising the size and the capacity of ships, which increased the pressure of efficiency in port. Ringsberg and Lumsden (2016) describe that the maritime companies intend to stress the logistics operation at port terminals to increase competitiveness, by eliminating the operation costs and risks, improve quality and improve energy efficiency. In fact, according to Hausman, et al. (2013), logistics performance plays a significant role in the level of bilateral trade since a high performance of logistics in ports' operations may increase the competitive position of the port in the global trade.

In order to maximise the efficiency in ports, automation in logistics operations and vehicles is introduced. Martin-Soberón et al (2014) state that the standardisation of performance and service level resulting from automation is connected with the higher control of equipment and processes and provides the possibility of reduction of the uncertainties in regards to response time, risks of costs and human errors. In order to improve safety and avoid accidents more efficiently, companies initiate Safety Management Systems (SMS). For example, Yui et al (2017) present the SMS as a way to minimise the workplace injuries and fatalities, reduce the waste of materials and eliminate the workplace hazards. Further, an effective application of a SMS may combine compliance with the existing regulatory framework, protection for

employees and improvement of health and safety in the workplace (Granerud and Rocha, 2011). Likewise, Fernández-Muñiz, et al. (2009) address that an effective SMS not only secure safety of life against accidents, but also increase the competitive level of an organisation by increasing the productivity and providing better economic results. The development of automation might not only affect the safety management system in ports, but also impact the organisation's sustainability. An introduction of automation in ports would require investments in infrastructure, while as Martin-Soberón et al. (2014) mention, that higher performance and increase of safety and security would impact economic sustainability. Simultaneously, the social aspect of sustainability would be affected in various ways from the introduction of automation in ports by offering more training to employees (Martin-Soberón et al., 2014) and providing a safer working environment with less physical stress (Theurel and Desbrosses, 2019).

Although studies have examined the safety in container ports, there is a lack of research on the safety in Roll-on/Roll-off (Ro-Ro) shipping ports with trailer operation activities. This limits the understanding on how automation impacts the existing safety culture in liner shipping companies involved in transport of trailers. In order to understand the impact of automation at a liner shipping company, this study aims to explain how a further implementation of automation would influence the reputation and cost indicators of a liner shipping company, which will have an impact on social and economic sustainability.

1.2 Purpose and research questions

The main purpose of this master thesis is to explore the influence of automation on safety culture in Ro-Ro shipping ports. Linked to the stated main purpose, the objective of this thesis is to address the impacts of further implementation of automation in reputation and economic indicators for the liner shipping company. Such indicators, will have further impact on the economic and social sustainability of the company.

Based on the stated purpose the following research questions have been formulated;

- What are the impacts of automation on the safety culture used by a liner shipping company?
- What are the economic and social impacts of automation on a liner shipping company?

1.3 Delimitations

The delimitations of a study provide the research scope and it is necessary to exist to make clear the limitations of the research process (Collis and Hussey, 2014).

Research limitations are defined as possible limitations that could affect the outcome of a study (Collis and Hussey, 2014). The study was adjusted based on a fixed time frame. For this reason, only factors important for the topic were taken into consideration, while some information provided were considered as granted.

Even though some academic knowledge connected with the topic of safety management measures existed, there was a lack of knowledge regarding the organisation and the company's port systems and SMS. For the purposes of this thesis, the methods chosen to collect data was through a case description where the author pinpoint important information related to the research. This information became available to the author either through public online websites or reviewed internal documents from the liner shipping company. Lastly, this information was always combined with knowledge gained from the literature reviewed provided by the university library. In addition, important data were collected through interviews and questionnaires, as well as through observation from visits to both ports of Vlaardingen and Gothenburg.

For this thesis it was decided that only the port of Gothenburg in Sweden and the port of Vlaardingen in the Netherlands will be investigated. These ports were the ones chosen out of the port's operations of the Ro-Ro liner shipping company due to similarities in legislations and operations level, as well as level of automation already introduced when the thesis started in 2020. During this study it was decided that only the trailers segment will be investigated, mainly because the operations of the liner shipping company in the port of Netherlands is mostly focused on trailers' handling. Moreover, this thesis focused only on the dry trailers moving general cargo due to different rules apply for handling of hazardous cargo in the port, complex safety protocols and regulatory compliance differences.

At this point it is important to underline that the research was held during COVID-19 period and for this reason the timeline of the thesis had to be extended. The author of this thesis found it difficult during this period to collect the necessary data by interviewing the right people in the company or receiving answers in the questionnaires mainly because the majority of people were either on sick leave, they were not available in the office, or simply because they were busy. At the same time visiting both terminals became possible for the author only after strict measurements against travel were lifted.

1.4 Report Outline

The outline of this master thesis is as follow:

- Chapter 1: Provides an introduction with a background and description of the problem. Also outlines the purpose of the research, the research questions and the limitations.
- Chapter 2: Presents the necessary theoretical background connected with the topic of the thesis.
- Chapter 3: The methodology which was conducted to solve the problem statement of the thesis is explained, including topics of research approach, data collection, reliability, validity and case description.
- Chapter 4: Presents the results from the study and simultaneously analyses them including a visualisation via figures.
- Chapter 5: The results and findings of the thesis are discussed, compared to the findings to the literature review and try to approach the research questions.
- Chapter 6: Concludes the mains points of the master thesis and answers the research questions. Recommendation for the future for potential future research and further investigation is proposed.

2. Literature review

In the literature review chapter will be presented the necessary literature connected with the topic and the process of answering the research questions. Topics such as liner shipping industry, efficiency in ports, process and infrastructure of handling goods, automation, safety management systems, risk assessment, safety training, safety culture, as well as the impacts in social and economic sustainability, are included and presented.

2.1 Liner shipping industry

The liner shipping industry, known as liner business, attracts the interest of a constantly enlarged market share, especially after the evolution of containerisation, bringing changes in the global terms of trade. Stopford (2009) separates the liner business in three parts based on the trade routes, the East-West trades, the North-South services, and the shorter-haul intraregional cargo trade. He continues by supporting that the demand in liner transport is determined, unlike in bulk services, by the relative price and the availability of goods. The exceptional reason for success in liner service and the factor that maintains liner business competitive is not only the satisfaction of demand, but also low cost and in large quantities. To achieve low cost and large quantities a liner shipping network is usually built where corporations are established among ports, member companies and their network partners sharing resources to have operational benefits, slot-sharing agreements created and multimodal transportation is a common practice (Lun et al., 2010).

2.1.1 Efficiency in port operations

To maintain competitiveness, efficiency should exist both in vessel capacity and scheduling, but also in port operations. Tongzon et al. (2009) show that the ports have started being more supply chain oriented, which imply that their tactical activities involve various flows in the supply chain. The supply chain way of thinking supports the maritime industry not only to overcome common problems such as role, functional or operational deficiencies occurring in a port, but also establish an extensive way of measuring the performance (Bichou, 2006).

Kennedy et al. (2011) further address that the investments in efficiency of logistics operations in port terminals has as result the increasing development of universal competition and trade.

At this point it is important to mention that according to Lun et al. (2010) ports have evolved during the last decades from cargo loading/unloading points to distribution centres with physical infrastructure serving as transport hubs in the supply chain.

In addition, the port infrastructure should not only handle vessels and cargoes, but also tolerate the current traffic and be able to foresee upcoming technological developments and changes in the port's operating environment (Lun et al., 2010). Because of this, there is a need for transformation of ports into hubs which can establish and provide value-adding services such as cargo consolidation or cross docking activities (Lun et al., 2010). This is supported by Bichou and Grey (2004) who mention development of 'third generation' ports into 'fourth generation' ports will not only have value adding services, but also the ports will have common operators and administration forming global multi-port companies.

However, it is clear that in liner shipping the cargo availability and the low costs are the most important factor affecting the performance (Stopford, 2009), the logistics operations efficiency at port terminals is not so easy to estimate (Kennedy et al., 2011). Factors such as the capacity and the productivity in terms of time, cost, and service quality should be taken into consideration when estimating the logistics operations efficiency measurement of port performance (Ringsberg and Lumsden, 2016; Bassan, 2007). Clark et al. (2004), however, state that other factors, such as the level of infrastructure or the existence of organised crime also have positive or negative influence on port performance. Cullinane et al. (2002) suggest that other factors, such as the size of a port or a terminal could positively affect the efficiency performance measurement. Bichou and Gray (2004) support that there are two main categories of measuring the performance of efficiency of logistics operations in ports; the macro indicator performance, which measures the performance of logistics port's operations efficiency based on the impacts on the availability of cargo and services, on the port physical infrastructure and the global trade (Ringsberg and Lumsden, 2016), and the micro performance indicator which measures the impact the efficiency of logistics operations in a port in essence of input/output ratio (Bichou and Gray, 2004).

Businesses being a part of the maritime industry have turned their interest towards efficiency in logistics management in port terminals to eliminate the costs and the financial risk and provide high standards in quality combined with energy efficiency (Ringsberg and Lumsden, 2016). Moon and Woo (2014) underline that the main interest is to efficiently manage the cargo

at port terminals in order to avoid market fluctuations and economic risks. Langen and Sharypova (2013) distinguish three different types of groups of interests in port's performance indicators: the port users, the policy makers, the port developers and other stakeholders. The attention of these groups is turned towards port's performance due to factors such as the costs, the transactions costs, reliability of transactions, employment in ports, environmental footprints and impacts in international and local level, etcetera (Langen and Sharypova, 2013). The high competition combined with a remaining need of low shipping cost and low levels of environmental footprint have put pressure on transport operations who seek ways to reduce transport cost and improve the quality of transport services, resulting in the creation of mega trailers. Nevertheless, the existence of mega trailers increased the need of good port performance due to the increase of loading/unloading time in the port, which increase the risk of congestion (Ringsberg and Lumsden, 2016), while it also increases the cost of transportation, and the need of more investments in the port in essence of technology and Information Technology (IT) (Kemp, 2015).

2.1.2 Standards

Many researchers explore the positive impacts connected with the application of standards and Information and Communication Technology (ICT) (Ringsberg and Lumsden, 2016; Clark et al., 2004). Clark et al. (2004) proves that introducing regulations and standards at seaports could affect efficiency in ports in a non-linear way. According to Clark et al. (2004) adopting standards could on the one hand impact the port's efficiency in a positive way, but an excess of regulations could result in opposite outcomes. It is the developing and non-structured ports struggling with world trade that are negatively affected by legal restrictions (Clark et al., 2004). The high costs accompanying the compliance with legal regulations and worldwide standards harm these countries' competitive advantage in world trade.

Complying with international standards is necessary for an effective implementation of information technology practices. The introduction of ICT mainly impacts logistics efficiency, and consequently port's efficiency, in a positive way (De Martino et al., 2013). Similar opinion is supported by Demibras et al. (2014) where the port-centric logistics theory represented and the complex operations following it will be benefited by the ICT systems creating a modernised port and moving towards developing an integrated system between port, customers, shipping companies to increase visibility and handle equipment more efficiently. By ensuring visibility of information exchanged regarding the cargo, the supplier, the consignee, the routes, etcetera

the efficiency is increased (Demibras et al., 2014), which as a result reduce the necessity of paperwork, the lead time and improve the custom clearance process (Ringsberg and Lumsden, 2016).

2.1.3 Process and infrastructure in handling of goods

In order to increase efficiency in ports' operations, it is necessary to explore and analyse the ports' infrastructure and cargo handling, since both are highly linked with the transport system and logistic system. Providing access to intermodal means of transportation by giving access to trucks and railway or services such as temporary storage or warehouses have a positive impact on the port's efficiency (Tsoi and Loo, 2021). In addition, exploring and analysing the cargo handling could provide useful information regarding the port's efficiency and areas of improvement. Yet, it is important to underline that different categories of cargo might slightly affect the way of cargo handling.

Carbone and De Martino (2003) present a cargo handling system trying to prove a correlation between cargo handling, logistic and transport systems. According to them, a transport system consists of shipping, cargo handling and delivery, where the cargo handling includes action of pilotage, towing, unloading, storage and loading (Carbone and De Martino, 2003). De Langen and Chouly (2004) characterise the activities of handling, towing, forwarding, storing, unloading, loading, assembling, re-packing, and consolidate, to be the activities of a more broaden aspect of steps a company needs to take in ports for logistics operations of cargo handling.

Ringsberg and Lumsden (2016) describe a structured way of cargo handling based on the EPCIS standard, by providing different activities as steps of handling cargo in export and in import of trailers. The implementation of standards is expected to complicate the cargo handling process since more activities would be necessary to take place in order to increase efficiency in ports. Ringsberg and Lumsden (2016) conclude that in export of trailers the activities of arriving to photogate, transporting, receiving or arriving to the main gate, inspecting, transporting, outbound/staging to terminal, inspecting, loading, receiving to ship and shipping the cargo are taking place. During the import of trailers, different steps occur with the process starting with the activity of arriving in ship deck, and the various activities happening such as inspection, transporting/ receiving or receiving/transporting, outbound/staging, picking the cargo and transporting in parking zone trailer, arriving in

photogate, inspecting and transporting or receiving in main gate, and lastly inspecting, receiving and shipping (Ringsberg and Lumsden, 2016).

2.2. Automation

Over the last decades an increased trend in port automated operational processes in container terminals and cargo handling has been witnessed (Wang et al., 2017), but also in roll-on/roll-off operations by automation of both the logistics process and the terminal trucks (Murgoitio et al., 2016). Murgoitio et al. (2016) support that automation benefits environmental, economic and social sustainability as it increases the transparency and visibility of information among stakeholders in the Ro-Ro transport value chain.

2.2.1 Impact in working conditions

There are two opposing views regarding the impact of digitalisation and automation on working conditions. Firstly, studies have been published which focus on beneficial points of digitalisation bringing up arguments like flexible working times, telework and home office, which maintain high value in many employees' lives balance (Haar et al., 2014; Grozdics et al., 2023; Singh et al., 2023). Haar et al. (2014) for example mentions that a good work-life balance can result in positive ranking in job satisfaction and decrease the amount of mental health issues. A good balance between personal and professional life is what matters most to the majority of the new generation (Buddeberg-Fischer et al., 2008). Hill et al. (2001) conclude that working with flexible working arrangements have positive outcomes in work-life balance for employees. Moreover, Theurel and Desbrosses (2019) support that the introduction of digitalisation and automation could mitigate the burden of physical labour and improve safety, and therefore protect employees from work-related illnesses. In fact, with advanced technology the stress of executing physically demanding tasks can be placed in automated machinery, protecting humans from dangerous environmental conditions.

Secondly, studies have been published presenting a rapid use and shift of automation and digitalisation and adverse impacts this might have on employees' well-being. The field of technostress, defined as the stress as a result of use of ICT, wants to primarily prove the negative influence the extensive use of the new technology can bring to employees' psychological well-being (Bondanini et al., 2020). Salanova et al. (2014) underline that technostress deriving from techno-addiction and techno-strain can short term lead to a "have

to" pressure feeling, anxiety, scepticism, inadequacy and fatigue, while in long term it can include physiological, psychosocial, organisational and societal consequences. Further studies regarding technostress address pain factors, like the lack of experience or confidence in new technologies, or the fear that one's job will be replaced (Tarafdar et al., 2011). This is supported by Green (2004) who supports that the escalation of work pace the new technologies created, demanded more rapid, reliable and transparent information, communication, production and distribution which increase the stress levels for employees.

2.3 Safety Management Systems (SMS)

The concept of SMS has drawn business attention through the years. It has not become easier, however, to give a particular definition of the term SMS due to a lack of consensus on what exactly the SMS is, what its principles are and its correlative scope (Robson et al., 2007). Other questions such as whether it includes only management components or if technical and operational perspectives might occur (Nielsen, 2000), have concerned the scientific community throughout the years.

Gallagher et al. (2003) perceived the SMS as a system that not only per sees the risk, but also improves the health and safety by planning and reviewing, managing the company's arrangements and other specific program elements working together to secure safety in a working environment. A SMS should be perceived mostly as a management system rather than just some policies or procedures written on paper (Mearns, Whitaker, and Flin, 2003). Labodova (2004) characterises the SMS as mechanisms designed to minimise the hazards and secure health and safety. Fernández-Muñiz et al. (2007) state that an SMS integrates a set of policies and practices to affect in a positive way the employees' perception and behaviours regarding risks. Thus, SMS is a system that alerts when performance indicators perceive that something is acting wrong in the system. It ought to be mentioned that a SMS is a management model that determines the functions, responsibilities, practices, procedures and process in order to assess or even prevent risk (Alvarez-Santos et al., 2018). In addition, there is a preliminary need for an efficient SMS to be framed by a number of laws and legal frameworks which have as a goal to secure effective protection of the employees and improve safety and health conditions (Granerud and Rocha, 2011).

2.3.1 Risk assessment

According to Badri et al. (2012) the way that a company analyses and assess its possible risks can be characterised as a safety management strategy. The strategy a company follows to adopt the SMS reveals how the risks are simultaneously managed (Alvarez-Santos et al., 2018). Bottani et al. (2009) do not separate the risk assessment from the SMS, but describe it as a safety management information system itself focusing on the analysis of the sequence of alerting situations and the transformation of them into levels of risks defined by the how often and how possible it is for them to occur. Thus, recognition and rating of risks are the main principles of risk assessment, which helps to identify the significance of the risks an organisation or its processes are facing at a particular period of time (Hopkin, 2017). Hopkin (2017) continues by supporting that the usefulness of the risk assessment is actually proven only when its results are helping into the decision-making process or/and the risk response. Mousavi et al. (2017) support this by stating that the risk assessment usually is perceived as a tool helping the decision-making process.

In order to aid the decision-making process, the risk assessment should be able to recognise and evaluate the risks, and then take measures based on each risk importance priority (Aven, 2016). In the maritime industry the dominant idea has been that human error was the main reason for incidents and accidents (Anderson, 2003). However, during recent years it is believed that human error just provokes the incidents or the accidents, but other factors connected with seafarers' training, emotions, motivations, working conditions, physical or social stress, etcetera, are the roots of the problem (ibid). This is supported by Mousavi et al. (2017) who addressed that the people recognising and evaluating the risk should be able to fully understand how employees' psychology and training in the emergency of a risk could contribute to the risk itself and its prevention.

In general, it is necessary for risk assessment as part of SMS to be also framed by a regulatory and legal framework. The marine hazards traditionally are regulated by IMO legislation and classification society rules. According to Mousavi et al. (2017), these regulations have been created based on previous risk crises by experts and propose specific solutions resolving specific problems. The risk assessment is only rarely used as a way to forecast and prevent risks, which is in contrast with the modern way of risk management which has as a prerequisite the existence of recognition and evaluation of risks and as a consequence the risk assessment

(Mousavi et al., 2017). In the shipping industry the operators do not usually assess the risk resources, unless it is requested by the law. This is because they do not think this is useful, since they prefer to evaluate risks only when required on a smaller scale, for instance between two options (Mousavi et al., 2017).

2.3.2 Safety training and safety culture

Nassiri et al. (2016) mentions that risk assessment can be perceived as measures taken to improve working and safety conditions. The risk assessment, and as a consequence the SMS, is correlated with the working environments and conditions, since major risks might occur during them. A risk assessment is a core SMS process collecting and analysing information connected with the working environment and conditions, work teams and relations employees might develop both in the working and industrial environment. This information is analysed in order to realise and evaluate existing risks, and create preventive strategies in accordance to their importance (Fernández-Muñiz et al., 2009). To make risk assessment practice beneficial despite its complexity, companies should invest in acquiring unification and broaden oversight of the working conditions, technology, health and safety, and relations with other co-employees, companies and suppliers (Papadopoulos et al., 2010). Alvarez-Santos et al. (2018) characterise risk assessment as a management model which does not only focus on plans, techniques and processes, but also creates value, common vision and commitment to employees. Granerud and Rocha (2011) support this by stating that a combination of risk assessment and the overview of the feedback received in the working and industrial environment result in improvements within the company. However, it is of equal importance for the companies to create the feeling of common target and motivation based on emotions to employees as it is to perceive or design an effective technique or strategy (Watcher and Yorio, 2014).

To manage an efficient SMS the safety aspect should be included in various processes in a company, people should take responsibility for them and employees should be properly trained (Segarra Canamares et al., 2017). Attwood et al. (2006) supports this by addressing that the lack of safety culture and properly trained employees could be characterised as an important failure of a company's management systems which do not prevent workers from acting unsafely. An effective risk prevention strategy, as well as a beneficial safety and health programme is linked to the existence of an effective training safety programme for employees (Vinodkumar and Bhasi, 2010). Training is one of the most important key elements for an

improving and always up-to-date organisation. Vredenburgh (2002) mentions that organisations should provide safety and health training and mentorings to employees in order to secure a safe working environment. The SMS is based on establishing safety routines for employees, which is created by incorporating safety norms into organisation's activities to achieve improvements in working conditions (Alvarez-Santos et al., 2018).

In order to achieve an efficient cross-functional collaboration aiming in a structured organisation wagering towards improvement and thriving, the development of a united safety culture within the company and among employees of different departments should be aimed. According to Garcia-Herrero et al. (2002) this might happen by each one undertaking the responsibilities corresponding to him/her to maintain the management commitment and develop safety culture after the safety training programs employees should attend. Alvarez-Santos et al. (2018) emphasise that maintaining a united safety approach encourages a culture working towards safety improvement by preventing the risks.

Organisations usually must face the problem that the safety models and strategy might exist, but still do not contribute to solving the safety management problem, since they are not integrated into the overall company's strategy and way of acting (Grote and Kunzler, 2000). Because of this, companies should not only aim towards developing a model of safety management, but should also create a culture of safety ready to accept and implement new models. According to Zohar (2010) the shared approaches define the safety culture when a company has to assess efficiently the occurring risks to maintain good performance.

2.3.3 Safety management and sustainability

The level of assumption of responsibilities from all employees combined with the existence or not of training programs have either positive or negative impact on safety, competitiveness and financial performance (Fernández-Muñiz et al., 2007). With the evaluation and analysis as a step-in risk assessment, various risks such as financial risks, safety risks, environmental risks, reputation risks, health risks and other types of business risks can be addressed (Mousavi et al., 2017).

Social sustainability

Providing a safe working environment to the employees should be one of the basic concerns of an organisation, as this might affect both the way the employees as key stakeholders see the

organisation and the brand, and as a consequence the reputation of the brand (Hopkin, 2017). Accidents and incidents occurring during the working hours could decrease the working motivation as the employees will no longer feel safe, might lower the satisfaction and the firm performance, and consequently the market position of the company might not be secured (Bottani et al., 2009).

According to Grote and Künzler (2000) the purpose of an implementation of SMS in an organisation might also be social, except the technical dimension of its nature. The technical dimension might cover the changes happening in processes to secure safety, the investment in equipment or safety technologies, whether the social include mostly the employees' rights and satisfaction and the relations created among employees. The majority of the companies tend to implement SMS for the social aspects of its benefits, which lead to an integration of safety in various practices of the company in order to improve the performance and meet customer expectations. The social aspect of safety can be also perceived by being the first step of risk assessments, as these are described by Mousavi et al. (2017). This step is about identifying the risk by understanding the effects it might have on people (employees, students, other people), information, financial indicators of the company and reputation.

Economic sustainability

Especially in periods of economic crisis companies usually focus on being efficient in production and minimising the costs, rather than dealing with improvements in safety and health as they see more benefits stemming out from this (EU-OSHA, 2018). However, the advantages of following an application of SMS are not only related with the social aspect of sustainability but also the economic (Alvarez-Santos, 2017). This is because a SMS does not only create a safe and healthy working environment and good working conditions, but also creates a climate of risk prevention and incident or accident minimising (Alvarez-Santos, 2017). According to Fernandez-Muniz et al. (2009) the SMS contributes to optimisation of both the performance levels and the economic indicators results of a company.

Mousavi et al. (2017) shows that accidents or malfunctions associated with industry (loss of cargo, loss of hazardous cargo), human lives (injuries, fatalities, loss of income, money spent in hospital care) and other causes (accident investigation, goodwill-loss), could result in a delay of the industry's functionalities and processes, and as a result in a loss of income. Cox and Vassie (1998) explain that industrial accidents and malfunctions could have a negative impact

on the economic sustainability of a company since disruptions in processes and production, damages in machinery and technology, and harm in reputation of the company might occur.

3. Methodology

In the methodology chapter the chosen approaches and methods are described and motivated to provide an explanation of how the research has been conducted and how information was collected. The research approach, the research design, the research method, the research analysis and the research quality are presented along with a discussion of research quality.

3.1 Research approach

According to Collis and Hussey (2014) the researcher is guided through the research paradigm, or as called the philosophical framework, during the scientific research. Guba and Lincoln (1994) describe the paradigm as a perspective of the current data and distinguish positivism and interpretivism as the two main different types, where positivism occurs from natural sciences while interpretivism is a result of the critical response to positivism. In this research the paradigm was interpretivist, as described by Collis and Hussey (2014), and used to analyse the complexity of social phenomena like how and why something happened. Blumberg et al. (2011) describe interpretivism to be used when researchers desire to reach a more detailed knowledge of the occurring phenomena. As this study is limited research, there was the idea of connecting the research questions with an example liner shipping case study company to provide solid answers.

Collis and Hussey (2014) describe the results occurring from the interpretivism paradigm to be generalised when similar situations with the existing ones take place, while at the same time the reality is subjective and in our minds. During this thesis, after being critical to the application of the author's perspective on topics to the real world, it was easy to understand that individual opinion and bias could affect the outcome of this research. Therefore, it was important to understand that interpretivism is about acquiring an in-depth knowledge and interpretation of various social events instead of relying on external forces and personal opinions. For this reason, it was of a concern in this thesis the research questions to be clear and concrete from day one.

Mingers (2012) recognise three different approaches in the process of collecting theory; inductive, deductive, and abductive. In this study the abductive approach was followed (Kovács

and Spens, 2005). According to the authors, an abductive approach follows the sequence of rule-result-case, with a simultaneous data collection and theory development. In the abductive approach the researchers' goal is to study facts to explain a hypothesis or why the situation occurs. Bryman and Bell (2011) explain that the abductive approach differs from inductive and deductive in that it does not require a strict logic and falsification hypothesis, but researchers build theories based on empirical data. At the same time Walsham (1995) proposed three different types based on the way the theory is handled; a guidance to gather the appropriate data based on existing theory, a repetitive process of collecting and analysing data simultaneously based on a case study, and to face theory as an outcome of a case study. This thesis combines the abductive approach with the repetitive process to handle data with theory.

In this thesis both qualitative and quantitative research approaches have been used in collection and analysis of empirical data.

Guba and Lincoln (1994) describe the qualitative approach as multimethod research being able to be combined with any research paradigm which has as a goal to explain various phenomena and meaning. Collis and Hussey (2014) state that the qualitative approach is more adaptive and focuses on the interpretation of the data. Moreover, a qualitative approach as a way of collecting data provides more in-depth and detailed data. Blumberg, et al. (2011) introduce numerous empirical materials used in this approach, such as interviews, observations, case studies, psychological tests, document analysis. According to Bryman and Bell (2011), the qualitative approach is used often when the information is collected through observations, texts' analysis and interviews. Observations, interviews and websites were the material used in this thesis to collect the qualitative data. Nevertheless, it is of an importance in this approach to understand that the reality provided is the reality that the respondents experience (Bryman and Bell, 2011).

Collis and Hussey (2014) mention that it is often that the researchers tend to work in two ways; either they gather the statistical data directly or try to quantify the qualitative data to be able to analyse the frequency of occurrence of an event. The quantitative approach is used when data is collected and analysed in their quantity, intensity and frequency (Bryant and Peck, 2007). For this reason, the quantity approach might be considered as a harder one due to the lack of knowledge in analysing statistics. In this thesis the quantitative approach chosen comprised

statistical methods. The method used was to quantify the gathered qualitative data, meaning quantify the collected data through interviews, observations, documents and questionnaires.

3.2 Data collection

Collis and Hussey (2014) differentiate the type of data in primary and secondary, with data collected from its origins, such as field notes and observations, to compose the primary data, while articles and reports to be the secondary data. In this study both primary and secondary data have been contributed to get useful knowledge and inputs regarding the topic, which will be presented in this chapter.

3.2.1 Collection of secondary data

For the collection of secondary data to identify research gaps and interesting topics requiring further research a systematic literature review (SLR) was conducted. In compliance with the stated purpose, the SLR was conducted about the SMS and possible impacts of the application of automation. Based on the SLR, the purpose of this thesis and the research questions were formulated, and the frame reference. The SLR was conducted according to the steps presented by Gessler and Siemer (2020):

1. Definition of the scope (identify research questions and search terms)
2. Data research and data selection (searching multiple databases, reading, etc)
3. Data screening and processing (screen for relevance, assessing quality of selecting sources, reanalysing the pooled data, etc)
4. Data reporting and synthesise the literature (relevant knowledge is gathered, findings and conclusions can be presented, research questions can be answered)

The approach chosen for the SLR in this thesis was thorough and the author of this thesis conducted a systematic review of existing literature published in established databases. The library of Chalmers University, the library of University of Macedonia and the library of Gothenburg University were used to select the literature. In addition, the Scopus and Web of Science databases were used to collect the literature. Keywords used in the literature search consisted of efficiency in port operations, safety in ports, safety management systems, risk management, process and infrastructure of handling goods, automation, digitalisation, impact of digitalisation in working conditions, social sustainability, economic sustainability. In order

to reduce the possibility of human errors or bias in systematic literature review, data-extraction forms are required, which normally contain information such as title, author, date, specific information and personal notes on emergency topics (Tranfield, Denyer and Smart, 2003). In this thesis, the relevant literature was gathered in a database where the title, the author and a small summary of the article were noted, accompanied by the weblink.

3.2.2 Collection of primary data

For the collection of primary data in compliance with the stated purpose of this thesis, a liner shipping company in the Ro-Ro shipping segment was studied in a pilot study and a case study. The company chosen was a shipping and logistics company operating in Europe. The company's initial target is the transportation of passengers and cargo internationally with safety and in time. Having as a first aim to explore how automation may influence the safety culture in the port and how this might impact the economic and social aspects of sustainability, a detailed investigation of the company's current situation was conducted. Primary data was collected in two steps; in a pilot study, and as a follow-up case study.

Pilot study

Given (2008) describes pilot study as a way to conduct or test the research. This is implemented in studies that have a clear purpose. Blumberg, Cooper and Schindler (2011) mention that the goal of the application of the pilot studies is to find disadvantages and possible errors in the design. In order to collect relevant data and material, and conduct adequate and proper interviews (Given, 2008), it was important for the author of the thesis to get familiar with the company under study. In addition to this, it was important during the study to receive support in selection of interview respondents. A pilot study was conducted in the early stages of the presented research in this thesis. The purpose was to gain insights of the company's SMS, safety culture and the current working situation in the port, and the existing level of automation in port operations.

Here it is important to mention that in this master thesis the first two interviews conducted were a part of the pilot study. These two interviews were conducted with the Health, Safety, Quality & Environment (HSQE) Managers of both Gothenburg and Vlaardingen ports. This was necessary as they provided crucial information about safety in ports and distributed to the author a list of managers to be potentially interviewed as well as a list of all the employees working in the ports. The author of this thesis, does not see a specific reason why the results

from the 2 interviews with the HSQE should not be included in the final results, as there was no bias during or after the interviews, or against the results. On the contrary, their point of view would be of a contribution in the development of safety matters in the port.

Case study

A case study was conducted according to Collis and Hussey (2014) guidelines. Bryman and Bell (2015) address that the case study allows the researcher to reach information regarding a complex situation or event. Likewise, Yin (2014) describes case study as a method which provides an in-depth and comprehensive understanding of social phenomena and their context, over which the investigator has little or no control.

Collis and Hussey (2014) mention that case study research consists of descriptive, illustrative, experimental and explanatory case study. In this thesis, the descriptive type of study was used to analyse the current situation. The illustrative type of case study was used to present innovative practices for the company (e.g., with the introduction of automation). The explanatory type of case study was used with the use of existing knowledge provided both by the company, while the literature review to develop knowledge about the situation. Further, Bryman and Bell (2011) address that the case study can be divided into four categories based on the subject; single organisation, single location, person and single event. Considering this division, the thesis is based on a single case study of a company. According to Yin (1989), six different types of evidence exist in case study research; reports, records, interviews, direct observations, participants observations, and data.

In this thesis, interviews, questionnaires and observations have been conducted as a part of data collection, while meetings with several experts representing different areas have been attended. Their purpose was to reveal the current situation and existing strategies in the company, with their bounded advantages and disadvantages, in order to add value to the research. In addition, it was of a priority during this thesis to take detailed notes during the data collection process in order to increase objectivity.

Observations

Given (2008) characterises the observation as a research method where researchers collect data by observing subjects in their natural environment without interfering with them or manipulate them in any way, but rather records their behaviour, actions or interaction with others. In general, it is of high importance for observations to happen unbiased under natural settings so

researchers can fully understand their terms of existence (DeWalt and DeWalt, 2002), while it is good to be collected from daily and repetitive activities (Schensul et al., 1999). 3. Collis and Hussey (2014) define two different types of observation; participant observation and non-participant observation. In this thesis the researcher used the non-participant type of observation as the initial goal was to study the operations in the port without external interventions. Here it is important to highlight that the observations were based on port operation and trailer handling activities and not port employees during the whole period of the thesis.

Interviews

Doing interviews is considered to be one of the most commonly used methods to collect qualitative data (Donalek, 2005). According to Bryman and Bell (2011), interviews in qualitative research are more generic compared to quantitative research since its goal is to collect and analyse respondents' own perspectives and generate patterns from their answers. Interviewing builds an in-depth understanding of the topic and ensures comparability among the conducted interviews (Bryman and Bell, 2015). Because of this, it is easier to find out which questions are relevant or irrelevant, while patterns and connections not previously recognised through the literature are exposed (Dunn, 2005). In this thesis interviews are mostly suited since they make comparability possible and reinforce generalisation of the population of the respondents. Conducted interviews in the thesis were based on respondents' own concerns and not interviewer opinion. Thus, semi-structured interviews were conducted, as the main goal was participants' communication and the interviewer role was only to frame the issue.

Semi-structured interviews consist of various topics with questions decided beforehand, but also provided the possibility to the respondents to lead the conversation into other interesting areas (Justesen and Mik-Meyer, 2011). Conducting semi-structured interviews give the freedom and flexibility to the interviewees to provide detailed and in-depth answers compared to structured interviews, while the interviewer still maintains the control of the discussion aiming in finding answers to the research questions more efficiently compared to the unstructured interviews (Bryman and Bell, 2015). The method of semi-structured interviews was chosen in this study as the more suitable one, since not only it provides the possibility to the interviewers to reach answers upon specific issues, but also offers a high level of flexibility in data collection.

The objectivity in data collection was tried to be as high as possible during the interview but not to a level that the interview was not welcomed for discussion for the respondents. The semi-structured interviews are characterised as having a lower level of controllability in comparison to the structured interviews, and as a result they might not lead to an absolute objective truth as well as the comparability among interviews might decrease (Bryman and Bell, 2013). In order to avoid the low level of comparability and increase objectivity, a limited number of questions were included in the interview guide (see Appendix I), while it was of concern during the interview that the discussion was turned back to the themes when needed.

Bryman and Bell (2015) present that the interview guide developed should be based on the theoretical framework examined in order to manage answering the research questions. Due to this, the interview guide consists of a combination of the formulated research questions and the issues deriving from the literature review. In addition, the questions are open-ended ones, which means that not only the respondent has the possibility to provide insights and concerns connected with the examined field, but also the possibility of missing valuable information for the study is decreased. As Longhurst (2013) addresses, the semi-structured interview was chosen as a method of collecting data since it not only provides the possibility to the participants to explore interesting and important topics, but also maintains a structure which offers a comparison among cases. In this study, the number of interviews conducted were 13 in a period of 4 months, and all of these interviews were conducted through teams with people who are experienced in holding daily meetings via Microsoft Teams. This method was used by the researcher as it was the only alternative due to the inability to travel because of COVID-19 restrictions. This is supported by Deakin and Wakenfield (2014) referring to the convenience that video-based software applications provide, allowing researchers to interview anyone anywhere, in the comfort of their own space and time, a one of the basic benefits they have to provide. In addition, it was made clear to all the interviewees from the beginning of this research being done and they are a part of it and their participation was voluntary. Last but not least, the participants were told that their anonymity will remain.

Questionnaires

Schensul et al. (1999) characterise questionnaires as a tool consisting a set of questions that are designed to elicit information from participants on a specific topic. According to Collis and Hussey (2014), questionnaires can be used in large-scale surveys, small-scale studies, and case studies. The authors emphasise the importance of careful questionnaire design. They note that

questionnaires should be designed with the research questions and objectives in mind, and should be structured in a way that is easy for respondents to comprehend and complete. Collis and Hussey (2014) further suggest that questionnaires should be pre-tested with a small sample of respondents to ensure that the questions are understood as intended and that the responses are reliable. During this thesis, the questionnaires distributed to the employees working in Vlaardingen port were translated into Dutch, as the language could be a barrier for employees not fully understanding the questions or participating. Before handing in the questionnaires, the questions were reviewed by people working in the office who used to be former employees of the port and employees of the port who will not participate in the questionnaires. In total 13 questionnaires were collected from both locations, Gothenburg and Vlaardingen port. For the questionnaire used in the study see Appendix II. Similar to interviews, the participants in the questionnaires were fully aware of the research being done, their participation was voluntary and they will remain anonymous.

Bryman and Bell (2011) discuss the main advantages and disadvantages following the questionnaires as a method of collecting data. They note that the main advantages are connected with the fact that it is inexpensive and it can be distributed to larger populations. However, questionnaires may not be an appropriate method for in-depth information, and the response rate may be low if the questionnaire is lengthy or if there is little incentive for respondents to participate. To avoid these disadvantages, the author of this thesis accompanied the questionnaire with an email explaining to the respondents the reason for the research and what will be the benefits for themselves in the long future by seeing how their colleagues in other ports work, how their safety conditions are and how each other feel about their safety during work.

3.3.3 Participating respondents

For this study 13 managers were interviewed, seven located in Vlaardingen and six located in Gothenburg **(Table 1)**. Proceeding with the questionnaires, the total number of the questionnaires distributed was again 13, equal to the number of the interviews, i.e., seven (54%) questionnaires were distributed to employees working in the Vlaardingen port and six (46%) in the Gothenburg port **(Table 2), (Figure 1)**. The numbers were chosen since the port office in the Netherlands is slightly bigger compared to the port office in Sweden.

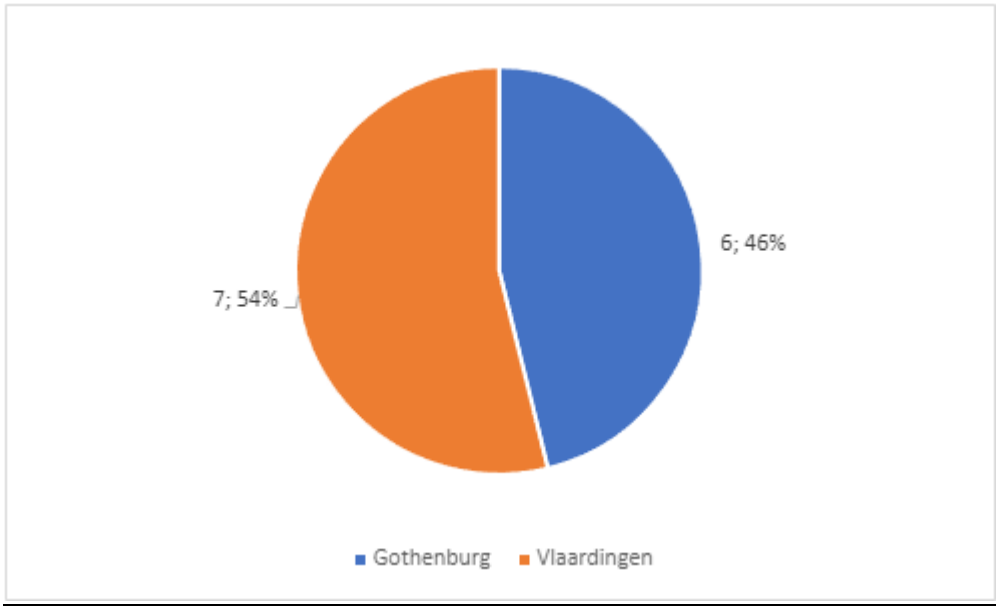
Table 1 - Number of participating interviewees

Position respondent	Number of conducted interviews
HSQE Manager	2
General Manager Terminal Ferry	1
Terminal Director	1
Manager General Stevedoring Gate & Security	1
Manager Technical Service & Workshop and Asset	1
Claim and Loss Prevention Manager	1
Infrastructure Manager	1
Shift Manager	1
Bridge Manager	1
Facility Manager	1
Supervisor, TSW & Asset	2
Total	13

Table 2 - Number of retrieved questionnaires

Position respondent	Number of retrieved questionnaires
Gate Coordinator	3
Supervisor	2
Foreman	2
Tugmaster driver	6
Total	13

Figure 1-Employees' location



3.4 Data Analysis

In this thesis the mixed method approach has been used as this is described by Bergman (2008). Hesse-Biber (2010) mentions that mixed method approach is usually used by researchers who apply both qualitative and quantitative methods to answer their research questions. Bergman (2008) explains the aims and advantages of mixed method approach as a combination of all the positive characteristics of qualitative methods and quantitative methods. Access to pluralism of data fast, rich data, extensive presentation of already held research results are some of the benefits coming with the mixed method approach (Green et al.,2015). Nevertheless, disadvantages like complexity in data collection methods are yet to be managed (Bryman, 2008). Greene et al. (1989) identify five reasons why a researcher should consider employment mixed methods, whilst a recommended framework and design is also presented. These five methods are; triangulation, complementarity, development, initiation and expansion (Greene et al., 1989). In this thesis, the method of triangulation has been used. Jick (1979) explains triangulation to use more than a method to examine the same aspect of a research problem to answer your research question. In triangulation the researcher first analyses the data and then shares the results to create an experience about a common phenomenon, but it is always important to remember the factor of researcher's bias/worldview, both intentionally and unintentionally (Fields and Kafai, 2009). Mixed method and triangulation are commonly used by students and new researchers as they can collect data through interviews, focus groups, direct and participant observations, and documents analysis (Fusch et al., 2018).

In this thesis, the author of the thesis first collected various sources about the safety management culture in the port **(Table 3)**. The data were collected based on pre-decided parameters which were of an interest to the author, but also might repeatedly appear in most of the articles. At a next stage, the author of this thesis collected sources and information about the automation in the port based on the parameters that would be interested to be investigated but also to be discussed in a later stage with the employees in a liner shipping company **(Table 4)**. From these two as point of reference, the safety management culture and the automation in port, the author of this thesis created an Integration Framework where the points of Linkages could be easily represented **(Table 5)**. Based on this table, the results and analysis sector of this master thesis was built, while the points of Linkages support the discussion chapter.

Table 3 - Unit of Analysis in Safety Management Culture

Safety Management Culture	
Parameters	**Frame of reference**
SMS	Gallagher et al. (2003) Labodova (2004) Fernández-Muñiz et al. (2007) Alvarez-Santos et al. (2018) Granerund and Rocha (2011)
Risk assessment	Badri et al. (2012) Alvarez-Santos et al. (2018) Bottani et al. (2009) Hopkin (2017) Mousavi et al. (2017)
Accidents experience	Labodova (2004) Mousavi et al. (2017)
Working motivation	Bottani et al. (2009)
Safety training	Segarra Canamares et al. (2017) Papadopoulos et al. (2009) Vredenburgh (2002) Attwood et al. (2006)
Feedback regarding safety	Granerund and Rocha (2011)

Safety procedures	Alvarez-Santos et al. (2018)

Table 4 - Unit of Analysis in Automation

Automation	
Parameters	**Frame of reference**
Existence of automation	Murgoitio et al. (2016) Wang et al. (2017)
Advantages/disadvantages (e.g. safety/efficiency/fear of losing work)	Haar et al. (2014) Grozdics et al. (2023) Singh et al. (2023) Theurel and Desbrosses (2019) Bondanini et al. (2020) Salanova et al. (2014) Tarafdar et al. (2011)
Safety procedures	Alvarez-Santos et al. (2018) Granerund and Rocha (2011) Vredenburgh (2002)
Cost indicators	Mousavi et al. (2017)
Reputation	Mousavi et al. (2017)
Terminal infrastructure	Carbone and De Martino (2003) De Langen and Chouly (2004)

Table 5 - Safety Culture and Automation Integration Framework

3.5 Research quality

The research itself should be evaluated to make sure that it contains a certain level of quality. The quality provided to research could affect the result of the whole study. Collis and Hussey (2014) mention that the research quality can be increased by reaching more detailed and in-depth information. According to Bryman and Bell, the author can be biased and their personal opinion might affect the results of the research (Bryman and Bell, 2011). During this master thesis, the author tried to identify and analyse the human factor playing a role in the final product to understand how it might impact the data collection. For instance, during the qualitative data collection with the observation method, it was of consideration the onsets of observation might shift their behaviours based on their personal mood during each day, or based on the knowledge that they were observed. Therefore, it was made clear to the employees working on the port that any data collected from the observations will not be focused on the them but on the processes. Being unclear on what you are researching for during the data collection might provide misleading outcomes, while unnecessary data might be collected affecting not only the quality of the study, but also costing time and money to the research. Notes were also taken during the collection of information in order to avoid a possible misplacement of data.

There are two key underpinning principles according to which the quality of a research should be evaluated; reliability and validity (Collis and Hussey, 2017). Reliability aims in evaluating

to what degree the study can be replicated while validity reveals to what extent the study observes or measures what it is expected to do (Collis and Hussey, 2017).

3.5.1 Validity

Validity is the method that checks if the study is appropriate and suitable in relation to the research questions, methods, design, data analysis and if the conclusions and results match the context (Leung, 2015). This conforms to the idea of Bryman and Bell (2011) about validity, supporting that it is connected with the accuracy of conclusions extracted from the research. According to Collis and Hussey (2014) results in interpretive studies are characterised by high validity.

Yin (2014) developed four tests of validity implying empirical social studies using case study as a method of collecting data; the construct validity, internal validity, external validity and research reliability. The first test developed by Yin (2014) referred to as construct validity, is achieved by using three approaches; the chain of evidence, the use of the appropriate informant for the review and the integration of multiple sources of evidence. During this research multiple sources of evidence were used throughout the study to reach the desirable results and answer the research questions. Published research was studied to understand and identify possible barriers. The professionals' opinion was appreciated during the research to increase validity, while interviews were based on professionals from different fields trying to capture the situation.

According to Bryman and Bell (2011) internal validity is about causality and answers the question of conclusions drawn derived from empirical findings. Mora et al. (2019) support that internal validity is a case study focusing on testing the feasibility of the procedure used. The internal validity could be compared with credibility as this is explained by Bryman and Bell (2015), where triangulation is fundamental. In this research not only the triangulation method was used by gathering information from various sources, but also notes, transcription and selection of respondents were stored to allow repeated access to the empirical data and track back the conclusions.

External validity is described to test the generalisability of the research (Bryman and Bell, 2011). On this occasion, important factors impact the result of the research, while they are tested and correlated with other similar situations. Blumberg et al. (2011) share the same

opinion by supporting that external validity aims in generalising the outcomes provided to times, settings and persons. At the same time, Collis and Hussey (2014) discuss that in interpretivism studies generalisation is of interest as the results can be transferred between similar situations. The results and discussion provided by this research could be useful for other companies focusing on introducing automation in their safety management systems.

3.5.2 Reliability

According to Bryman and Bell (2011), reliability in a qualitative method is concerned about providing replication of the findings in a study. Leung (2015) argues that although a margin of variability in results could be accepted, the reliability of research lies with consistency. Collis and Hussey (2014) continue describing that the reliability is a way to present how precise the result of a study could be. The use of semi-structured interviews as a method to collect data makes the replication of the study difficult, which negatively affects the external reliability.

To increase reliability in a study, Silverman (2009) represents five possible ways of making the study more comprehensive: Refutational analysis, data analysis, comprehensive data application, inclusive of the deviant case and use of tables. In this thesis the data were collected from the original sources, while triangulation was used to collect data. According to Levitan et al. (2011) in this way the reliability of a study is increased. In this thesis, the triangulation is added in parts to increase the reliability, for example the main sources in each subject aimed to remain above three for the researcher, the use of different ways to collect data through literature review, interviews, questionnaires, observations and internal sources. Additionally, the researcher had in mind during this thesis that the personal worldview and bias might affect the subjectivity of the study (Ratner, 2002; Fields and Kafai, 2009). The triangulation is used as a way to avoid and limit the subjectivity.

4. Case description

In this chapter the case study liner shipping company will be presented and described with the necessary information, having as a purpose the deeper and in detail understanding of the company's approach on health and safety, and vision on digitalision.

4.1 The liner shipping company

For the purposes of this thesis, the company chosen to be investigated is Ro-Ro liner shipping company, a leading company in the field of logistics and Ro-Ro shipping which is operating nowadays mostly in the North Sea, Baltic Sea and Mediterranean. This study included ports in Vlaardingen in the Netherlands and in Gothenburg in Sweden, from which the sample of respondents both for interviews and questionnaires, but also data from observations were collected. The two ports under study were chosen as the operations were approximately the same and the set of regulations followed in these two countries regarding safety seems to have many similarities, compared to other countries in the EU.

The liner shipping company is an international company with three main distribution elements; Freight Ferry which covers the most of the total revenue, Transport and Logistics solutions which includes mostly full loads, partloads solutions and contract logistics which covers the second largest part of the total revenue, and the Passenger services which are provided on nine routes and cover the third largest part of the total company's revenue. The company is characterised to be a supplier who aims towards sustainable and digital transformation developing sustainable solutions for the generations to come. The company pays equal care to economic, environmental and social sustainability. Hence, a culture of equality, inclusion and understanding, caring and support is created.

The liner shipping company is described to be an employer with a great focus on social sustainability; supporting diversity & inclusion at work, human rights, business ethics, equality, aiming to create space in a masculine industry for women in all organisational level, and always striving for employees mental and physical safety, aiming for employee engagement and community engagement. In addition, it is characterised as a company investing towards economic sustainability to have a clearer overview of the economic activities that contribute

the most to the EU's environmental objectives. To support these investments, the company applied a classification and informing system called EU Taxonomy Climate Delegated Act (the taxonomy) which first identifies the company's economic activities, and then determines if the economic processes are covered by the economic activity descriptions included in the taxonomy.

4.2 Health and safety

The liner shipping company is investing and trying to improve the overall performance of health and safety, as many of its employees work in high-risk environments, such as outside in the ports or on the roads. To maintain safety of employees, the company implemented a global health and safety department which has the role to inform, raise awareness and take proactive measures to reduce health and safety risks. This department has as its initial goal to investigate the current safety culture of the company and develop a health and safety culture ready to proactively minimise risks. The liner shipping company had already from 2020 started investing in employees' well-being and safety by starting specific programs across the business. The programs' purpose is to keep a note of all the near misses and accidents, increase awareness of risks and avoid dangerous behaviours, strengthen safety culture, and eliminate accidents. These programs helped to gain a broader overview of the location and the reason for the occurrence of the accidents, which is a useful tool in reducing similar types of risks in the future.

The need for such programs focusing on employees' safety and wellbeing occurred due to tragic fatal accidents such as the one that occurred in a port area where the company operates in 2021. The accident happened in 2021 costed the life of a seafarer together with the rising number of LTIF *(Lost Time Injury Frequency)* indicated even more obviously the need of this new department and of investments in new technology and digitalisation which will reduce the land-based health & safety risks in the terminals and keep employees safe in the future.

4.3 Digitalisation

The company's growth strategy is settled in an ABCDE way, pointing the direction of how the company wants to grow while maintaining a low environmental footprint. Its main goal is by keeping the company competitive to maintain people and customer oriented, while being a pioneer in offering greener and digitised operations. The letter B in the ABCDE growth strategy

of the company stands for the need of digitalisation of services to succeed in the acceleration of growth. The company's concept of necessity for adaptation into digital transformation is that any failure to this development could lead to long-term loss of earnings and customers with possible fatal losses for the company. The company perceives technology as a risk that would have a relatively medium-low financial impact and likelihood to occur, and the mitigation strategy the company follows includes evaluation of changes in the business environment and investigation of development opportunities.

The company's most important focus areas for digital transformation includes programs to digitise customer relationships, implement digital solutions to achieve sustainability goals and increase operational efficiency by automation. Fully self-service platforms as well as EDI and API systems are integrated in the company to increase efficiency.

5. Results and analysis

In this chapter the results from the interviews, questionnaires and observations will be presented and analysed, having as a purpose the deeper and in detail understanding of the situation at the liner shipping company.

The researcher's priority was to first interview the managers in both Vlaardingen and Gothenburg locations. The researcher wanted first to discuss with the managers, and especially with the HSEQ managers some more technical issues regarding the legislations in different countries and if the liner shipping company has an SMS. After the interviews were conducted, the questionnaires were distributed to the employees in the port. In the meantime, observations were conducted from the researcher during the visits in the ports. The main goal was to collect as much information as possible regarding the current safety situation at the port, the risks, if and how the implementation of automation could improve safety, as well as the impacts on social and economic sustainability a further automation could bring in a liner shipping company. Additionally, the writer of this master thesis wanted to support this research with further questions such as if the safety training they have today seems to be enough for the work requirement in the port, and what accidents occurred in the past and how they handled it. The initial goal was for the researcher to explain the reason for this study, to gather as much information for the safety in the port. Here, it is important to mention that overall, the feeling of the results is that although both managers and employees working in the port were focused in efficiency, the managers seem to prioritise more the safety and training towards that direction, whereas the employees working in the port have a less helicopter view and seem be unwilling to change their way of working unless it is to make their work easier.

5.1 Safety Management Culture

All of the interviewees (100%) concluded that the term SMS is not usually used or/and known, but instead the liner shipping company is relying on a systematic environment work with existence of a system providing detailed description of the procedure that should be followed in various works/operations in the port to work in a safe manner. According to the interview with manager 6, in this system employees have the possibility to report incidents and accidents, and follow ups, while their daily safety procedure includes documented rules to be found in

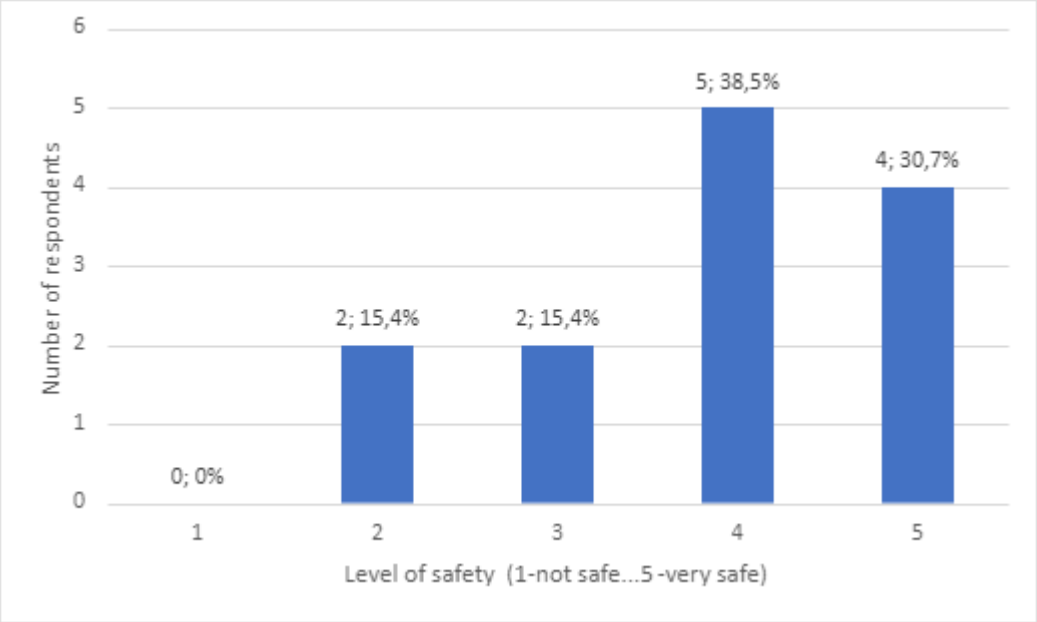
this system, but also unwritten rules. Interviewee 1 underlined that in the liner shipping company a systematic environment work is presented, where countries following similar legislations can follow similar health and safety rules. Manager 1 mentioned that all HSEQ managers and safety related people tried to use the same platform to work in similar ways in the liner shipping company, but it was fruitless since the legislation is very different in each country. At the same time, people have different ways of working and reporting accidents in various countries. However, interviewee 1 supported that the legislation in Netherlands and Sweden are similar when it comes to safety and health therefore we can cluster these two countries together.

All respondents in the interviews (100%) agreed that a further implementation of a SMS would be beneficial as anything increasing safety could be only positive for the terminal's efficiency, the employees and the company. Nevertheless, according to some comments received, limitations should be placed to maintain the system efficiency. According to the interviewee's manager 7 opinion, this system should not be overloaded with minor incidents/ accidents, but only with important incidents/ accidents to keep it as a problem-solving tool and not as a reporting risk tool. Respondent manager 7 discussed on this matter that there are necessary limitations to be placed if a SMS is implemented to use it as a problem-solving tool instead of risk reporting tool.

"The system itself can help. The problem with this system is that it becomes a list of minor things that are not really an accident/ incident, but a cry for attention which makes the system get overloaded and no one takes it seriously anymore. If we implement this kind of system, we need to put limitations and we need to use it as a problem-solving tool instead of just a reporting risk tool." (respondent number 7).

One of the main topics of investigation and understanding was how safe do employees feel in their daily work in the port and if this comes in line with the level of safe working environment the managers have created for them. The employees in the port in the questionnaires were asked to rate on a scale of 1 to 5, where 1 is not safe at all, 2 is pretty unsafe, 3 is average, 4 is pretty safe and 5 is very safe. According to analysed questionnaire results, the majority of the respondents were on the positive side, with the 38,5% feeling pretty safe and 30,7% feeling safe working in the terminal, while only 15,4% feel on average, the same percentage (15,4%) feel pretty unsafe and 0% in feels not safe at all **(Figure2)**.

Figure 2 - Safety feeling of personnel working at the terminal



These results show that the liner shipping company has managed to create in general for the employees the feeling of safety while working in the port, that they are protected and if something happens to them that they will be taken care of. This is also confirmed in the results from analysed interviews.

The respondents in the interviews supported that the company's priority is to always secure a safe working environment for its employees. There is room for improvement when we are talking about safety, and this is why many projects are being supported and financed currently, but in general everything in the power is being done to secure a safe working environment for anyone working in the company.

During the interviews it was of interest to understand if risk assessment is perceived as a management tool for the managers for the decision-making process. The majority (77%) of the respondents replied positively, as they mention that they go through a risk assessment process before a new process and small changes, or per process and activity every year depending on the location. Manager 1 mentioned that risk assessment is so important for them that in the future they want each routine to be adapted to the risk assessment they get.

“We don’t want the risk assessment to be the new routine but we want the ordinary routine to be adapted to the risk assessments we get, something that is not happening today.” (respondent number 1).

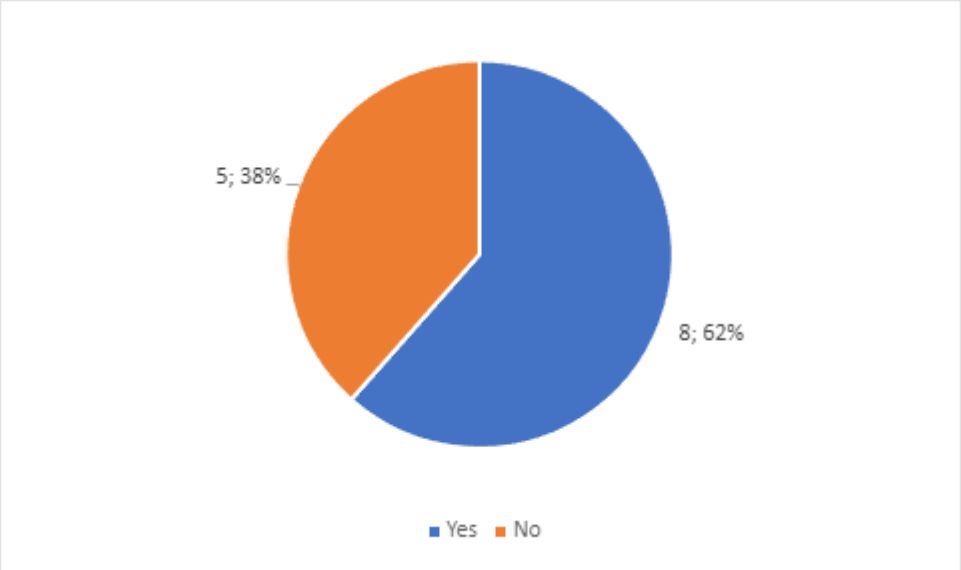
On the contrary three of the respondents replied that the rules are already settled and the risks are already assessed. They argued that the people in the port do mainly the same thing in the port every day and information regarding how to handle tools in a safe way are sent from suppliers. Additionally, manager 4 mentioned in the interview that their assessment of risk is based on experience, while manager 9 continued that there might always be something going wrong that you cannot do anything about, even if things are taken good care of.

In the question if they have ever experienced any incident or/and accident in their working environment all the respondents in the interviews (100%) replied positively. The answers varied from small injuries causing employees to stay out of work for some days, to fatal accidents because an external driver made a human mistake.

"Yes, when the accident happened the whole day was lost, but the day after we went back to work as usual.” (respondent number 6).

It was of interest to question if the employees working in port have experienced any accident from their side while working at the terminal and how would an accident at the terminal affect their motivation to go to work. Questionnaires’ results show that 62% of the employees working in the port have experienced an accident while the rest 38% have not **(Figure 3)**.

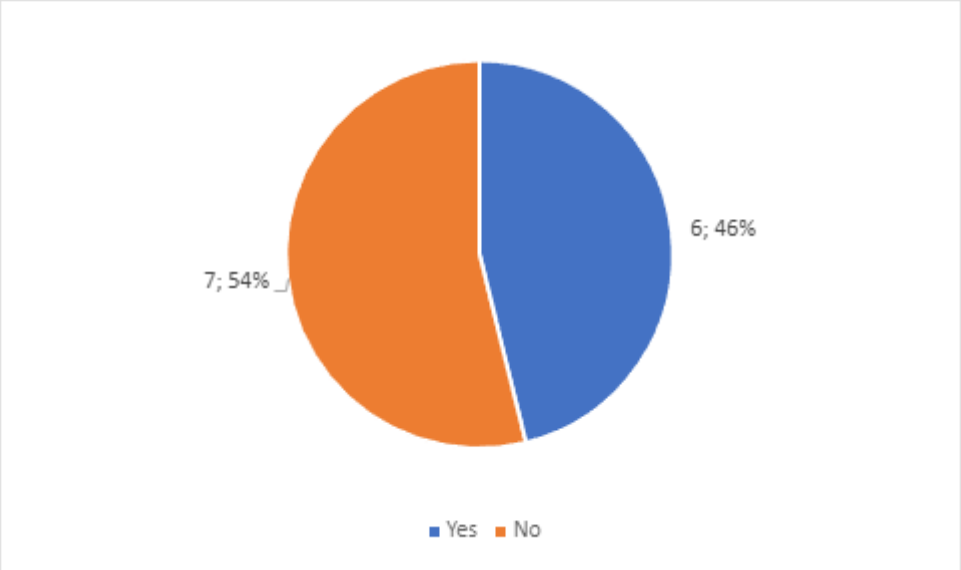
Figure 3 - Terminal personnel accident experience responses



The results derived from the questionnaires showed that more than half employees working in port have experienced an accident and/or an incident while working in port. The same result was given from the interviewees, which gives in general the feeling that this is an area of future improvement for the liner shipping company.

Close to that question, it was important to understand if the employees working on site have experienced that port operation stopped because of an accident, as this is strongly correlated to the economic and social sustainability of the company. 54% of them have replied negatively and 46% positively **(Figure 4)**.

Figure 4 - Personnel feedback on accident-related port work disruptions



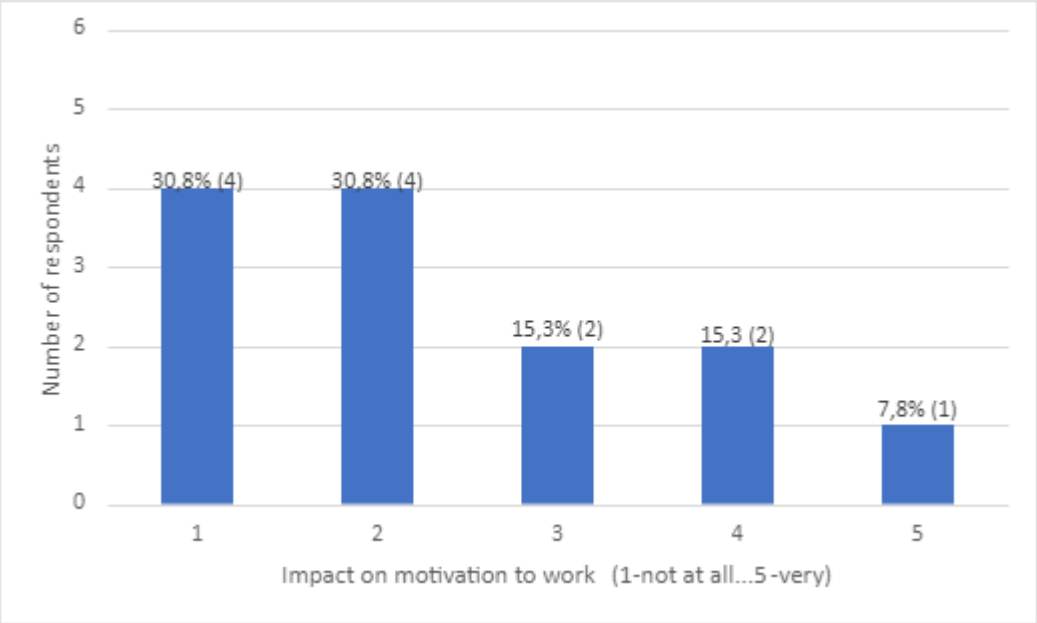
All the respondents of the interviews (100%) have replied positively that they have experienced disruptions in port operations after an accident and/or an incident, but the majority of them discussed that these distributions lasted only the day of the accident. As interviewee number 6 supported, delays in delivery the work in time occurs as after an accident the whole day is lost, but the day after everyone is back to work as usual.

The question regarding the influence of an incident and/or an accident have to the fluctuation of working motivation and if they see any impact in essence of time, money or reputation for the company, it was difficult to be answered and each interviewee manager approach it differently depending on the knowledge and the field they are working on. In general, the majority of the respondent managers (85%) supported that depending on the level of seriousness of an accident the greatest influence it has both on employees but also on reputation. In a fatal accident for example the employees can become shocked and the company always offers support to them with specialised consultants. Manager number 2 address that an accident may have an impact in social sustainability as it creates questions to customers and decrease the efficiency to employees, while it cost time and money. Nevertheless, the productivity remains unchanged according to manager 6. This happens because the planning divisions planning the vessels are always trying to take the production off the area of the accident and concentrate on the other decks, as manager 12 mentioned.

"Yes always, it creates a lot of talk on communication radio. If it is a severe accident, many of the employees get a warning that this is serious … Regarding the time, it takes some time, but the planning divisions planning the vessel are always trying to take the production off that area and move on to the other decks." (respondent number 12).

Similarly, the employees in the port in the questionnaires were asked to rate on a scale of 1 to 5, where 1 is not at all, 2 is almost not at all, 3 is average, 4 is quite some and 5 is very. According to analysed questionnaire results 7,8% of the employees replied that their motivation would be highly impacted from an accident, while the majority of the respondents replied that their motivation most probably would not be impacted or would only slightly be impacted with 30,8% in score 1 and 30,8% in score 2 **(Figure 5)**.

Figure 5 - Impact on working motivation for personnel



Here it is interesting to see that the results from the interviews and the questionnaires seem to be aligned. The level of the influence an accident will have on employees' motivation to work depends on the seriousness of the accident, if it happens to a colleague of theirs and if they were a witness of the accident. Although the employees are motivated to work more safely, they are still willing to do their job. Hence, the productivity does not change.

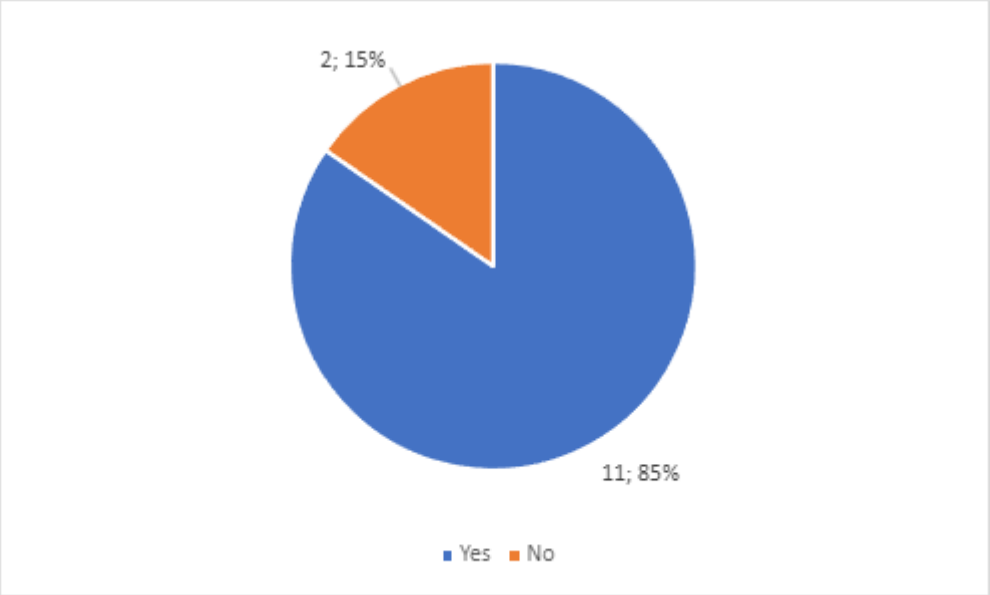
Another interesting information can be concluded if we combine information together. From analysed questionnaires it can be concluded that respondents that have experienced accidents during their working hours tend to score lower in the question regarding their motivation to go to work after an accident occurs. The results from the interviews show that the majority of the interviewees have replied that the level of productivity is not affected when an accident occurs in the terminal. Thus, the employees might be shocked and worried, but this does not impact their productivity. Of course, as the interviewee number 5 supported, this might have been different if a fatal accident happened to a colleague of the employees in the port, as so far all accidents were minor and the only accident with an unfortunate death was of an external driver. Interviewee number 11 also said that some accidents can be called freak accidents, which means that no one can foresee them and these are the ones that might have a fluctuation in working motivation. Last but not least, the interviewee number 10, claimed that the safety issues occurring in the port sometimes require more time than usual to be solved and the employees are feeling neglected and as a consequence frustrated as they feel that the managers do not care about them, affecting heavily their working motivation.

Regarding how often the employees receive training in the port, all the interviewee managers (100%) were aligned in their answers. They mentioned that depending on what they are training about, they might have training often or seldom. The target is to have all training every year of course. They all agreed that for every new employee a full education/ training & safety information is offered. According to manager 3 a mentor is assigned to every new employee in the port who has to onboard them and guide them through the safety processes.

"Every year … When you start working in the company, you have a mentor to guide you through the way to work and safety processes. You learn these things from day 1 and you practise them every day." (respondent number 3).

At the next step the employees at the port were asked if they feel that they have received enough training to feel safe while working at the terminal. 85% of the respondents gave a positive reply and in total 15% of them a negative reply **(Figure 6)**. At this point it is important to underline that all of the respondents that replied negatively have experienced an accident while working in the port.

Figure 6 - Terminal personnel training satisfaction survey



The interviewees discussed that frequency on which the employees working on the port receive training varies depending on what they are training about, leading to receiving often to seldom training per topic. Nevertheless, it is offered full training and safety information. From the analysis of the questionnaires, we can mention that in general the employees working on site are overall satisfied with this safety training they receive to work in the terminal, even though there is still space for improvement.

All interviewed managers (100%) replied positively that all employees working on site feel welcome to give feedback regarding safety in the working conditions they experience during their everyday work. They supported that all personnel are trained in the way that everybody is responsible to tell their managers if they see a risk. Additionally, employees can fill in a form for near accidents or deviations and put them in a box or hand them over to be reviewed. According to interviewee manager 1, Swedish legislation says that if there is a vital risk in the work task the employee should stop working in regards to that risk and directly report the risk to the manager or to the safety representative. Manager and safety representative can call a safety stop of work and depending on the situation request further investigation by Law.

The results from the questionnaires seem to be fully aligned with the results from the interviews in the question. When the employees were asked if they knew what they should do if they wanted to report an accident, most of the employees united by replying that they should follow

the rules about the safety, refer to their supervisors and/or raise a ticket and discuss it within the team. It is clear that indeed all employees are trained in a way that it is their responsibility to approach their supervisor and/or safety supervisor if their manager is not available, or they can anonymously report an accident in a form according to interviewees number 1 and number 2.

Approaching the end of the safety management culture topic started in the beginning of this chapter, the interviewees were asked to describe the safety norms and routines employees working in the port should follow in their daily port, and if the employees working on site are fully aware of these routines. The interviewees discussed that all employees are fully trained regarding the safety routines, folders exist with safety routines and how to work with them, managers should inform everyone, and additionally they have a start meeting every morning where if something is wrong or if something is new they should address it. Interviewee number 8 mentioned that the working clothes and correct work equipment (gloves, helmet, glass, jackets, boots, etc) is necessary for someone to enter the quay.

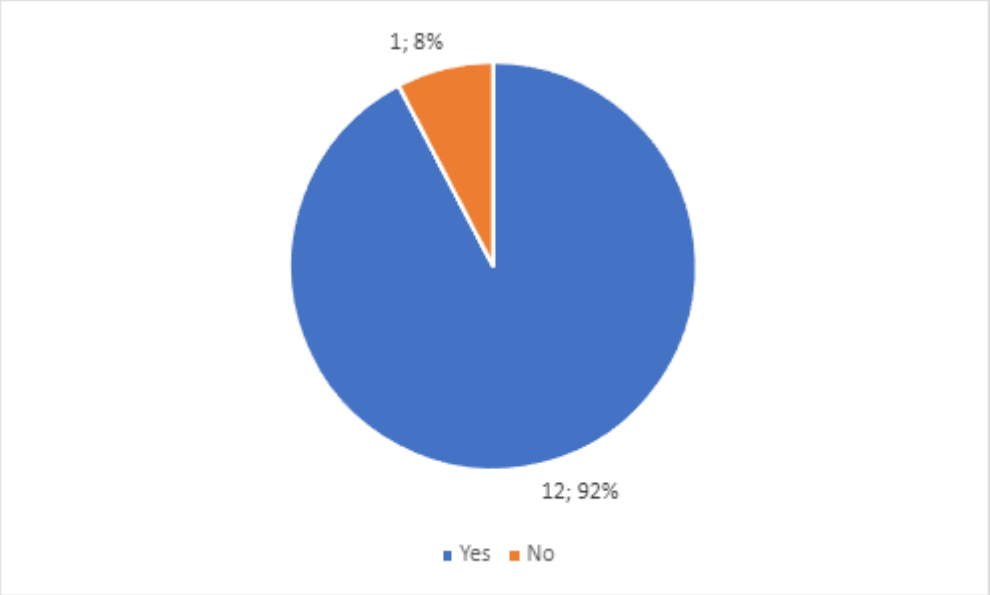
Everybody is given working clothes and the correct work equipment they need (gloves, helmet, glass, jackets, boots, etc). If someone is not wearing this on a daily basis, they are not welcomed out on the quay. … Other than this all of the rest procedures are considered a part of their daily work to be safe. If someone is neglecting the rules, we talk to them directly on site and if they still don't follow the rules then they are not allowed to be in quay or with company anymore." (respondent number 8).

Additionally, before the vessel starts, they always check the cargo for leakage or damages and inform the staff. According to manager 8 the rest of the procedures are considered part of the employees' daily work that if someone does not comply with then they are not allowed to enter the quay or even work with the company.

It was interesting for the writer of the thesis to understand if the employees are familiar with the current safety rules that must be followed in the port. Here it should be mentioned, that according to the interviews that have been conducted before by the researcher, the interviewees supported that not only workers in the terminal are trained according to safety routines, but also folders of safety routines accessible to everyone exist, managers should keep everyone informed and before the start of their shift they should address and be addressed if something

is wrong or/and if something is new. From the questionnaires derived that the majority of the employees working in the port replied positively in the question if they are familiar with the safety rules that must be followed at the terminal, with the negative replies to cover only the 8% **(Figure 7)**.

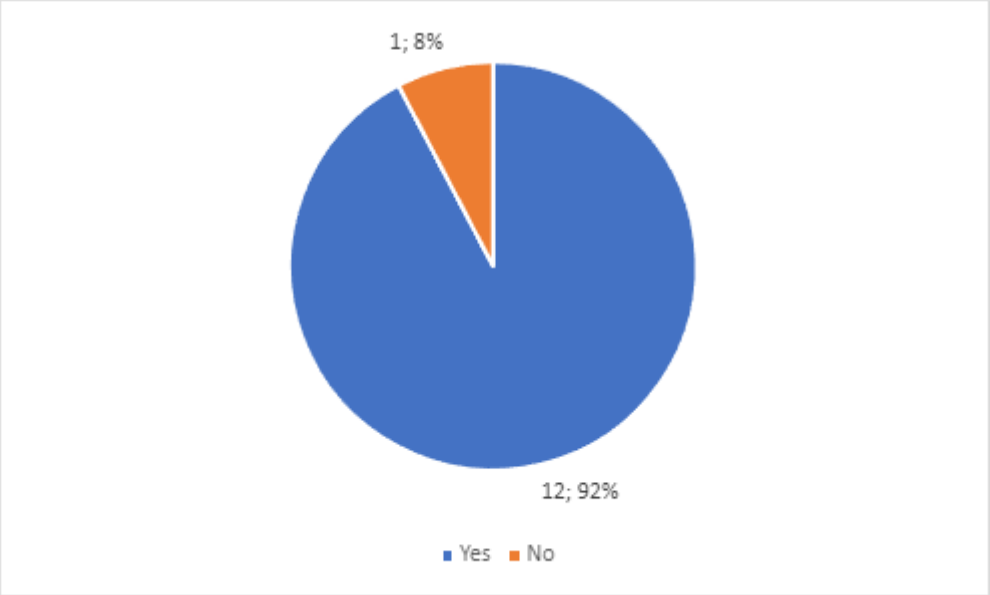
Figure 7 - Employees terminal safety rules awareness responses



Many of the interviewees, such as interviewee number 8 and number 4, are discussing about the equipment and clothing necessary to use to enter the terminal (gloves, helmet, glass, jackets, boots, etc), something that is confirmed from the researcher's observations as the employees were always wearing these clothes and equipment on the port. Additionally, according to manager 6 although in the port there are specific walking paths, they are not very strict with this rule. The same result was derived from the observations from the port operation and trailer handling activities as it was often for port employees to walk outside of walking paths after their break to return back to normal business.

Combined with this question, it was asked if more safety rules would have a positive impact on employees' safety. 92% of the respondents believe that more safety rules at the terminal would have a positive effect on their safety during their everyday work, while the 8% who have the opposite opinion are mostly Tugmaster Drivers **(Figure 8)**.

Figure 8 - Personnel's opinion on additional safety rules at the terminal



The result derived from the questionnaires - if we take into account the replies the respondents gave to previous questions - can lead us safely in one conclusion; if there is a room for improvement in safety, employees in the port would choose it as they believe that this will always have a positive effect on their safety.

5.2 Automation

For the second part of the questionnaires related to automation, the author of this thesis decided to include some examples of automation that have been observed both during the visits on the port but also were discussed during the interviews. These examples were the camera system in the gates that takes pictures of the units gating in making sure to verify whether the unit was damaged before entering, the LOT/SAT trestles securing and lashing the trailers, and the Terminal Management System an automated system providing a place number to park the trailer after entering the gate. It was chosen to provide existing examples of automation in the questionnaires so the participants can easily relate and not be scared by the word, as well as the word itself was replaced by the term "technical innovation".

All interviewees (100%) agreed that in both ports a lot of automation already exists. According to manager 9 in the port cameras are installed for safety reasons not only to prevent any accidents or/and act in time on them, but also act in time when people intruders without

permission are found in the port. Respondent 6 supports that the camera in the gate is a current form of automation existing in daily work. From the observations of the author of the master thesis it is confirmed that the cameras in the port are playing a vital role in the safety and security in the port illegal immigrants are often prevented. Interviewees number 4 and 5 are both discussing automated trestles securing the trailers in port making the process much faster and easier, while respondent number 7 is describing a maintenance and logistics system which helps him with invoices as a part of automation he is daily using at work. Lastly, according to the observations of the author of the thesis the employees in the gate, but also the whole port, is organised based on a Terminal Management System which navigates them while loading and discharging of the vessel, and shows where to park and pick up the equipment in the port. All interviewees referred as well to this Terminal Management System the liner shipping company is using to help them simultaneously with the planning of the vessels with loading and discharging. This system can show them where each trailer is located in the port to pick up, drop off, and if it has any defect or/and damage.

"We have a Terminal Management System where people can see where the trailers are and they can pick them up and if they have picked them up they can show it in the system by pushing a button, they don't have to write it, everything is automated to make work easier and safer." (Respondent number 2)

Additionally, it was important to understand what do employees consider as automation in their daily work in the port, therefore in the questionnaires they were asked where do they see, use or receive help from automation in their daily work at the port. Aligned to observations and interviewees replies, employees gave various examples of automation in the port. Such examples were the computers they are using to work with, the computers in tug masters, the Terminal Management System, the cameras on gate helps them in inspections for security reasons, the automatic customs clearing, the SOT/LOT trestles as you do not have to tighten, etcetera. A respondent from questionnaires comments that he can recognise automation in all aspects, and that there are many fields where technical innovations help them. He feels that they greatly benefit from automation in their daily work, especially when it becomes a huge time saver like the photos in the gate which makes manual inspection in the gate obsolete, and they even have a tool to help calculate departure time for the vessels.

One comment that got the author of this thesis attention was that automation could make some difference if the external drivers also knew how to handle it, in the question which parts of your daily work you see opportunities for improvement for automation to make your work safer, easier and more efficient. This goes back to the comment from the interviewee number 7 that the system is only as good as the user of it. It is highly important for the liner shipping company to fully educate all of the users of the automation in order for them to feel confident and be prepared to correctly handle the equipment before entering the terminal to ensure smooth operations in the terminal. In general, this question also has some answers mentioning that the existing systems can be further improved, probably more insights can be linked with the licence plates and trailer numbers of the trucks to make the employees in the gate work more efficient, the loading process might be an idea to be improved.

Here it is interesting to see the difference between the answers that the respondents of the questionnaires and the participants in the interview provide. In the same question if the automation could exist in more parts of the port, the interviewees reply positively having a more helicopter view. They support that automation makes daily work safer and requires less people which leads to economic benefits for the company. Respondent 1 gave an example of self-monitored tug masters in different parts of the port which would be a good investment for the future, as driving double stucks is really risky and limiting human factors could take the risk away. Additionally, he mentioned scanners used to scan every truck managed by hand. In the future, this should be automated and cars should go under a scanner-bow, which would make the whole process faster and easier. Managers 4 and 5 discussed alternative ways to check what cargo you have on terminal, such as smart cameras, safety cameras on tugs, drones, etc, while respondent number 2 talked about path-planning methods for trailers combined with self-driven forklifts. According to manager 8 the health and mental benefits could be combined from the introduction of automation in employees' working on side daily working environment.

"...we should automate that by self-driving cars, and this would be a good thing because the drivers doing this job today have a shift for 8 hours but they are quite tired in their back and their shoulders…I believe that a one-sided job like that should be automated, because it affects the driver, it makes the driver lose focus on what he is doing." (respondent number 8).

In general, we could say that the managers from their point of view are trying to build a safe and time efficient working environment, which most probably in the long term will require less manpower on site. The respondents of the questionnaires seem to have a less helicopter view and focus more on their part of their problem. The majority of the answers did not focus on the safety, but on the efficiency of the job they are responsible for, which would eventually also affect the safety. Lastly, they seem to try to divert focus from themselves as they are only focusing on changes in systems or external drivers, which shows that they might be in denial to possible further changes.

With the employees having already touched upon this topic, the writer of this thesis wanted to receive more concrete answers from the respondents during the interviews regarding the advantages and disadvantages that an extended existence of automation in port would bring in the daily work routines in their opinion. According to manager 1 the increase in the safety will follow an extended existence of automation in port, as the work in port is really heavy with a lot of vibration and many accidents and damages could happen daily. With automation a safer working environment could be created for the employees but also the port infrastructure could have less damage from the daily misusage it tolerates at the moment. Everything would be much better controlled overall, something that would save a lot of time, would be economically efficient and would be beneficial for the company's reputation. Respondent 8 discussed that with automation they will be able to plan ahead. He continued saying that automation does not need any breaks, unlike humans, which means that everything can be planned in advance and in time. Although all respondents agree that automation would save time, respondent number 3 supported that automation will not allow them to notice and obtain in time control of a malfunction relating to safety or operating issues.

"Not having control in time; for example, when a person is operating a work if a safety issue and/or other fault occurs then it can be fixed in time. By using automation, the mistake might be noticed too late". (respondent number 3).

Here it is interesting to compare the results of the interviews to the results of the questionnaires. The participants in the interview discussed advantages regarding work efficiency, which eventually would save a lot of time and they will be able to plan ahead. Nevertheless, their focus is connected to employees' safety first, port infrastructure which will tolerate less damage due to less misuse of heavy equipment, and finally the company's economic efficiency and

reputation. In the questionnaires, the respondents in general also underlined the efficiency, fast pace and easier work, focusing on benefits such as reducing the manual work into various systems, less man hours, the system helps flagging potential issues with cargos, the work can be physically easier but also since it is pre-planned can become more logical and clearer. In the questionnaires the focus shifts away from the safety itself to the fast pace and efficiency at work.

The main disadvantage that almost all of the respondents discussed is the fact that automation is connected in the employees' minds with the fear of losing their jobs. Other disadvantages are connected with the expensive maintenance of the automation in the port, and very intense and clear training to the employees for the new automation.

"People in the port don't like the thought of an increase of automation, as the people controlling the automation system would be well educated people in high levels and not the operators. They might be afraid that they would lose their job." (respondent number 2).

On the contrary, respondent number 1 mentions that eventually the employees working on site would understand that a move towards automation of ports would create a safer working environment for everyone, and therefore he places the staff support in the advantage side.

"The staff; although everyone thinks that they are scared of losing their job, I don't agree with this opinion. I believe that they understand they will be safer by an extended existence of automation in port." (respondent number 1).

Respondent number 7 discusses that the system is only as good as the users of it.

"We have to put in all the information in the system and every time we do something wrong the system might stop working. The system is as good as the user of it." (respondent number 7).

Here it is interesting to mention that both the respondents of the questionnaires and the participants of the interviews have mentioned the same examples of disadvantages that would potentially follow an extensive existence of automation in the port. The respondents of the

questionnaires mainly focused on two disadvantages. Firstly, the majority of respondents focused on the fact that the increase of automation in the port might limit the need of manpower on the site and this might increase the fear of losing jobs due to being replaced by machines. At the same time, the respondents of the questionnaires discussed that working with automation humans no longer have a complete overview of the process and in the event of a malfunction the operations stops because there is no possibility to fall back in the previous process. Lastly, it has been underlined that in fact working with automation is not always safe if you do not know how to use it or if you do not pay enough attention, and people tend to work in autopilot and pay less attention when you work with automation since its possibilities are more trustable.

In the question how would more automation might influence the safety procedures followed today in the port, it was discussed by all interviewees the fact that will for sure lead to the need for more training, while the port infrastructure might change as there will be less humans - for example the path-ways. At the same time, the majority of the respondents reply that the automation will create a safer working environment for the employees working on site not by eliminating the risk but by providing information in time regarding malfunctions in order to boost safety.

"If we have automation as a system then all information would come to employees sooner so they might be able to assess the risk sooner and find a solution to it. Automation would not take the risk away, just give us the information in time to boost the safety and minimise the risk." (respondent number 3).

Similarly, in the questionnaires the respondents were asked to express their opinion if they think that the safety of the daily work in the terminal might change by using automation, and if yes in which ways. All of the answers received were positive. The respondents were discussing a less heavy workload requiring less manpower and physical power allowing the employees to be more alert to what is important but also saves time. Other views were that with the help of automation, for example cameras, you can have a better overview of what is in the terminal which makes terminal operation much easier, and other that being able to move around a safe route in a terminal is always beneficial as it contributes to a safe working environment.

This was followed by the question of how the implementation of more automation would

influence the day-to-day work in the terminal. It was of a general impression that the influence would be positive overall, but again here the respondents in the questionnaires discussed that the automation needs to be correctly implemented in the first place to avoid additional frustrations, as well as that the people using it should be fully trained on its use. This comes hand in hand with the interviewees' idea that the automation is as good as the employees using it, and the importance that the correct and sufficient training holds in the company. The day-to-day work will become more efficient with the implementation of additional automation or automated processes as for example there will be less need for customer service errands or administrative tasks being time and energy consuming. The terminal's operations will become faster and more efficient, the data will be easier to be collected overall, the work prioritisation will be clearer for everyone and eventually day-to-day work will be safer, more efficient and faster for the employees.

All respondents (100%) agreed that the cost indicators for the company will be influenced in a positive way with the extended existence of automation in port. In fact, automation will not only reduce injuries, but also make the work faster, saving time and allowing employees to focus on work that they really have to do instead of doing the administration of them.

"It will save some time, the number of injuries will be decreased, and also employees will be focused only on doing the things that they have to do (driving, stowing, etc) instead of doing the administration of it (fill in the information in the system) so it will be safer." (respondent number 7).

Here is it interesting to highlight some of the facts that came out of the interviews and questionnaires which have a direct influence in cost indicators. According to manager 1 and 2, between years 2017 to 2020 in total 63 lost time injury accidents were reported, and 185 minor accidents not leading to lost time. Out of them, only two were caused due to machinery, while the number of lost days per month in total is approximately 40 per year. The two managers continue underline that when a full-time employee is injured, the liner shipping company has to hire another employee to replace the full-time employee, has to cover his/her salary and treatment cost, has to cover the insurance costs, might have to pay fines up to EUR 50.000 or more from authorities, etcetera. In general, every injured employee with lost time could cost at least from EUR 300 to EUR 1000 additional per day to the liner shipping company.

In the question about how the company's reputation might be influenced by the introduction of more automation in the port, the interviewees separated their answers into two parts; the reputation among employees and the employees in the market/customers. For the reputation that would be created in the market all the interviewees agreed that it would be positive as the company will appear to be a conscious employer prioritising employees' safety, while being trustworthy, managing to deliver in time and meet customer demands. For the reputation created among the employees not all interviewees think so positively. In fact, half of the interviewees believe that employees will always have some kind of resistance to the new and this will lower the reputation of the company if we implement more automation in the port as their fear of losing their job or resistance of their job changing is coming in the front line. Manager number 10 is proposing that it might be a solution to implement the change and let the employees experience it.

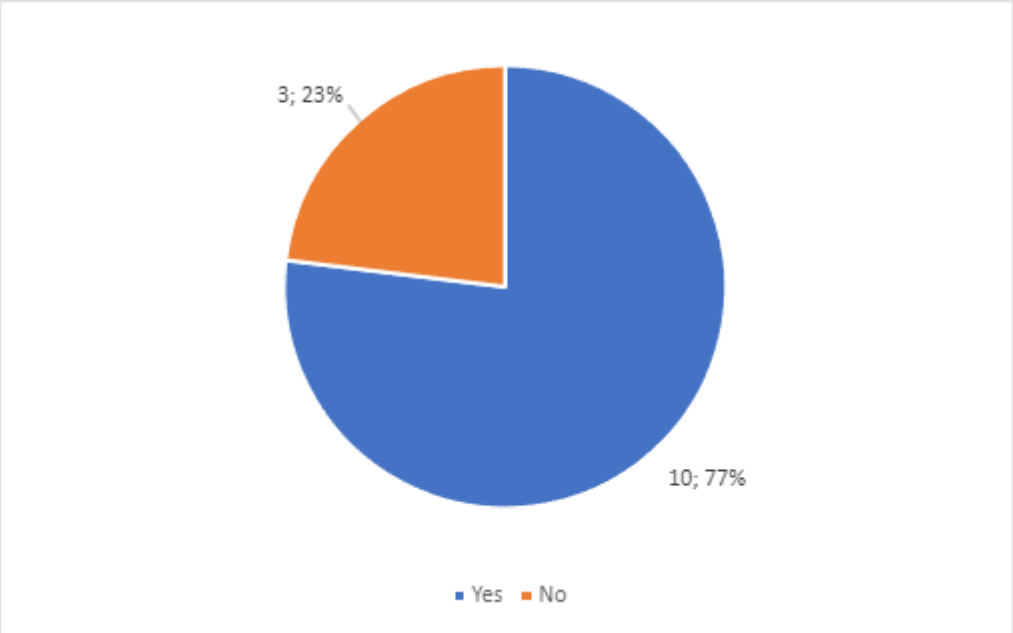
"…But then when there are new rules, then as human nature wants, they resist the change. Just to make it clearer, when you ask about it, the answer is no. But when you implement the change and let them work with it, then they understand the benefits of it that it might help. The best way might be to implement the change and let them be a part of this change by letting them experience it." (respondent number 10).

At this point it should be mentioned that similar to the respondents of the questionnaires, the participants of the interviews supported that the influence of implementation of additional automation in the port would be beneficial. Again, both underlined the correct usage and implementation of automation from day one. Nevertheless, the participants of the interviews seem to be able to envision a future with less people in the port as they are using examples including the path-planning technologies and how that might lead to a change in infrastructure and the new training that might come with this. Another difference that is obvious is that the participants in the interviews do not foresee a future without any risks due to automation, but a future where automation is able to help humans boost safety in time by providing enough information.

In the question if the liner company they are employed would be a better employer if it would invest more money in automation/technical innovation or automated processes at the terminal

to make the respondents' work easier, the 77% of the respondents in the questionnaire replied positively and a comparatively big percentage of 23% replied negatively **(Figure 9)**.

Figure 9 - Personnel insights on liner shipping company reputation: investing in automation



These results seem to match what the participants in the interviews were discussing that the employees, unlike the market acceptance, are more reluctant to the change most probably for various reasons. This will always lower the reputation of the company among some employees if we implement more automation.

Whether the implementation of more automation would have an effect or not on the terminal's infrastructure and operations was a point of disagreement among the interviewees. Half of the interviewees supported that the terminal's infrastructure will remain unchanged or that the change will occur only when there will be some difficulties with the current layout, while others supported that the implementation of additional automation will come hand-in-hand with changes in port's operations and infrastructure. Manager number 5 discussed the need to reorganise the terminal and the way the trailers are parked, which will lead to the need for path planning and blockchain technology support.

"Not sure yet since I don't know how they will organise this change, but we need to think about the way we park the trailers since the automated tugs can only move forward or backward → this might lead to a need of separate area with path planning, also we might need blockchain technology to share the information. The port in general has the ability to accommodate heavier equipment." (respondent number 5).

The employees working on site united in their opinion that more automation in the terminal will indeed have some influence in the port's activities, infrastructure and operations, unlike the participants of the interviews. According to the respondents of the questionnaires, these changes will make the daily work for some parties easier and faster, but for others more complicated. In general, the work would become much easier and smoother for the drivers who would be able to work more efficiently, although in the event of malfunctions they should be trained to know how to handle the equipment properly. In that case, an order will exist in terminal management for how to unload the vessel and where to park the trailers in order to avoid the unnecessary congestion inside and outside of the terminal. In this way they can align the terminal according to cargo flows based on peaks and dip hours. At the same time the idea was discussed that the cargo should be correctly and fully identified when entering the terminal and direct them to the correct areas in the yard. Here, it is important to mention that one of the respondents of the questionnaires actually discussing about the possibility that after the implementation of more automation not so many employees will be needed anymore in the port and that is okay because we will still need competent personnel who can keep the operations up manually while someone needs to talk to customers and colleagues if needed.

6. Discussion

In the discussion chapter the results will be combined, analysed and discussed with the literature review, to understand and underline similarities and dissimilarities between these two parts. This chapter will be connected to the research questions and will work as a foundation for upcoming conclusions and future recommendations.

The discussion chapter of the thesis was structured with the priority to analyse the impacts of automation on the existing safety culture of a liner shipping company. To do this, an overview of the current safety culture had to be gained and aspects of Safety Management System, Risk Assessment, accidents in working environment and effects in working motivation, port operations, safety training to be examined, in order to analyse the impacts of implementation of automation on the existing safety culture. Additionally, the author of this thesis had the ambition to go one step further and examine the impacts this change would bring in social and economic sustainability of the liner shipping company.

To increase validity and accuracy of the results in this study, except the extensive research and literature review executed regarding the liner shipping and its characteristics, the author of the thesis included as data collection methods the interviews from the managers and the distribution of the questionnaires in the employees working at the terminal. At the same time, the author of the thesis managed to collect some observations during the visits to the ports.

Both the interviews and the questionnaires were conducted in March and May 2021 when COVID-19 was still in its high season. The questions were adjusted to be close to the vocabulary the participants of the interviews and the respondents of the questionnaires use. Additionally, after the interviews it became clear to the researcher that the term Safety Management System would be a difficult term to be described and included in the questionnaire, especially since the liner shipping company is not using something similar to it at the moment. On the contrary, it would be of an interest to examine if the respondents would include in their answers the systems the company is already using and to investigate if in their answers they will prioritise safety instead of being confused with additional terminologies.

6.1 Safety Management Culture

To answer the first research question, it was important to understand the current safety culture the liner shipping company has. The literature review mentions that the SMS is not only a system that could understand and predict risks, but is a management system created to improve health and safety by planning, reviewing and integrating specific system elements (Gallagher et al.,2003). It was of a priority for the author of this thesis to first checked if SMS is a common practice for the liner shipping company. Although the interview results show that the term SMS is not widely known or used within the liner shipping company, a systematic environment for safety is widespread. From the analysed results in chapter 4 it was shown although SMS does not exist, the liner shipping company has managed to create the feeling of safety for the employees while working in the port for them to feel protected if something happens to them that they will be taken care of. Labadova (2004) underlines the need to observe the SMS as a system for risk minimisation and employee well-being, while Fernández-Muñiz et al. (2007) characterise SMS as a system which positively influence the employees' perception and behaviours against risks via a set of integrated policies and practices. The current safety system in place in the liner shipping company consisted of a set of detailed procedures for the existing port operations, while specific processes for safety and incident/accidents reporting are in place. Despite the terminology gap, according to all respondents' opinion a further implementation of SMS would be beneficial for the company, something that aligns with the author's of this thesis point of view. Focusing on the safety in the port can positively impact terminal efficiency, employees' motivation and overall company's reputation and performance according to the results of the questionnaires and according to interviewees opinion. Nevertheless, as resulted from the interviews, there should be a limit in the way that the system is being used to maintain the system efficient. SMS should prioritise significant accidents/incidents for it to be used as a proactive problem-solving tool instead of minor-issue focus solver.

Although the SMS may not be widely recognised and commonly used within the liner shipping company, a systematic safety environment is noticeable. This is shown from the questionnaire results where the majority of the employees replied that they feel pretty safe or safe in their daily work in the terminal. The proof of the company's commitment to provide a safe working environment is that they are using procedures very similar to SMS, even if they are not named by the company as SMS. Of course, the potential of further implementing an SMS is there for

them to maintain effectively by setting the appropriate limitations. For example, as resulted from the interviews, one of the main issues is that different laws and legislations apply in different ports. Granerud and Rocha (2011) highlight the need for the SMS to be framed by a number of laws and legislations to improve safety and secure employees' well-being. In that essence, having an in-depth knowledge and understanding of local and global legislations and focusing on the differences of reporting incidents and handling accidents makes SMS a valuable problem-solving tool.

According to the literature review, the risk assessment is one of the most important aspects of the SMS, as it enables the identification and management of potential risks, and it increases the safety among employees (Badri et al., 2012; Alvarez- Santos., 2018). As the risk assessment is connected to identification and evaluation of potential risks, it is believed by the author of the thesis to be connected and to be also very important for employees' safety and well-being as it might have an impact on how safe employees working on the terminal feel in their working environment. Bottani et al. (2009) describe risk assessment as an aspect of SMS focusing on the analysis of situations that might require extra attention, while reshaping risks into quantifiable risk levels. Keeping in mind all the literature review, it was interesting for the author of this thesis to understand if a risk assessment process is fully established in the liner shipping company. From the analysed results it became clear that while the majority of the respondents (77%) indeed perceive risk assessment as an important management tool for decision making, others work only based on settled routines and rules in their daily tasks. The author believes that this diversity of perceptions and actual experiences pictures not only the complexity of risk assessment as this is described in the literature (Anderson, 2003), but also underlines the level of difficulty added when implementing terminologies such as SMS and risk assessment in different levels of expertise leading to opening the terminology gap among level of employees. Nevertheless, the author agrees with the results that the risk assessment should not be perceived as a prearranged practice, but as a way to adapt and find middle ground between routines and prepare for unexpected challenges.

In order to understand in depth if the systematic environment for safety the liner shipping company has created for its employees is fully working, the author of this thesis wanted to further investigate the frequency of incidents/accidents in the working environment, and the frequency of their impacts such as disruptions in port operations. Labodova (2004) observes the SMS as a mechanism focusing on minimising risks and securing employees well-being,

while Mousavi et al. (2017) characterise the risk assessment as a tool helping the decision-making process. Although having incidents/accidents in the working environment is a part of it, especially when we are discussing a high-risk working environment, nevertheless their occurrence underlines the need for a shift towards a more structured safety system. The significance of a structured SMS and proactive risk assessment becomes even more clearer given these results. The general feeling from the results of the interviews, questionnaires and observations, is that there is room for future improvement and development when it comes to safety in the liner shipping company.

According to the author of this thesis the employees are key guardians of a company's reputation and it is of great importance to maintain their working motivation high by providing to them a safe working environment. Bottani et al. (2009) underline the impact of a safe working environment on overall company's performance, employee's motivation and satisfaction, and as a consequence company's reputation. Hence, it is important for the liner shipping company to invest in its safety, since a fully functional, safe and secure working environment is an attractive and motivative workplace that benefits the company's reputation. As discussed before, accidents and incidents in the working environment are a part of it that can influence the working motivation. Nevertheless, the company's efforts to support and increase safety plays an important role in managing negative impacts and maintaining a productive work atmosphere.

To ensure security and efficiency in the working environment safety training should be the top priority for the liner shipping company. Segarra Canamares et al. (2017) address that it is crucial the safety aspect to be a part of various processes in a company to achieve efficiency in SMS, while employees should be properly trained. As resulted from the interviews and the questionnaires, the general feeling from the terms SMS and risk assessment terminologies is that their complexity level is high and the different ways of approaching them depend on the reporting position someone might hold and possibly the expertise level. Literature review proposes that the best way for the companies to acquire unified oversight in working conditions, risk assessment, technology and employee commitment to health and safety is by establishing safety training (Papadopoulos et al., 2010). The results from both the interviews and the questionnaires mention how important is the safety training in the daily routines of employees and emphasise the strong company's focus on safety. According to Vredenburgh (2002) organisations should organise safety training for employees to ensure a safe working

environment. The company today has many safety trainings focusing both on onboarding new employees but also on demanding processes. However, as mentioned there is always space for improvement as ideally the management team has a target to have more training programs that will repeat at least once per year. This might also improve the 15% percentage who do not feel that they have received enough training. Recognising that these employees might have experienced accidents in the working environment emphasises the need for further focus on safety training for the company, since as Attwood et al. (2006) mention appropriate training is necessary to stop from acting unsafely.

It soon came to the author's realisation that it is of company's great value to receive feedback regarding the safety. Granerud and Rocha (2011) address the positive impact of feedback in the working and industrial environment leading to improvements within the company. The results from both the interviews and the questionnaires confirm that employees are trained in the liner shipping company in a way to provide safety- related feedback. The procedures are well defined for everyone to follow for accidents, near accidents or deviations. This highlights that in this case that we are talking about a lines shipping company who proactively take steps of improvement towards safety where employees are not there only to observe but to participate in maintaining a secure working environment. Of course, as mentioned in the interviews, what creates some obstacles in the processes are the differences in the legislations and cultures among various countries. According to the author's point of view, a united SMS framed by a number of laws and legislations, as this is characterised by Granerud and Rocha (2011), clustering countries based on specifications and adjusting accordingly would be beneficial in cases like this to improve safety and secure employees' well-being.

According to Alevarez-Santos et al. (2018), the SMS is a management tool that determines functions, responsibilities, practices, and procedures to assess and prevent risks. For this reason, it was of great importance to examine the existence of safety procedures in the port, if the employees are familiar with it and if the employees working in the port would appreciate the existence of more safety procedures. The results from the interviews, the questionnaires and the observations provide an understanding of the safety rules existing in the terminal operations. The employees seem to be familiar with the safety procedures and the safety routines should be sufficiently clear to everyone, including guidelines, morning meeting, clothing, and equipment, underscoring employees' commitment to safety. The observation emerging with the comment from interviewee regarding the walking paths, is one example

showing that there is still room for improvement in safety in port operations. Nevertheless, the collective positive feedback that additional safety rules would have a positive effect, once again highlights the proactive culture in essence of safety where employees are active members in it.

6.2 Automation

Having a broaden view on the safety culture of the liner shipping company, the author of this thesis wanted to understand what would be the influence if we implement more automation in the port, aligning with the increasing trend in automated processes in both logistics and terminal trucks in roll-on/roll-off operations (Murgoitio et al., 2016). All the respondents confirm the existence of automation in the port, highlighting its role in safety efficiency and supporting the workflow. The automation confirmed by the author of this thesis observations appears to be the same as the automation confirmed by respondents in the interviews and questionnaires results. The segments of automation that exist in the Ro-Ro terminals, as these observed by the author of this thesis and confirmed by the respondents of the questionnaires and interviews, are mostly connected with the security of the terminal with the gates in the camera, the cargo handling, and the Terminal Management System which not only support the operations in the port but might be helpful in operations in the office.

The respondents underline the benefits resulting from the automation in their daily tasks, emphasising the positive influence of technical innovation in port's operations. An observation of high importance, according to the author's point of view, is that automation is as good as the people using it as interviewee number 7 mentioned. That highlights the proper user's education to not only achieve the full potential of automation, but also to avoid misuse of automation which might lead to opposite results. Additionally, it should be kept in mind that when we are talking about automation there is always space for further improvement for even better integration, both by better employee engagement but also investing in better mechanisms for port operations to make work more efficient and faster.

The benefits following a further implementation of automation in the port discussed by the respondents are connected with additional safety, time efficiency, economic efficiency, and less risks. According to the author's point of view, a further implementation of automation in the port might increase the need for a more structured SMS and risk assessment where everyone will be fully aware and trained who to reach and how to report in each situation. In this case,

when a malfunction occurs due to automation, everyone would know how to handle it without causing big disruption in the port operation affecting negatively the social and economic sustainability.

The discussion around the advantages and disadvantages of automation is of interest in understanding in depth the safety culture of the liner shipping company, emphasising the movement towards digitisation and automation. From the interviews and questionnaires, it is highlighted the benefits that may occur as automation could replace physically demanding tasks leading to accidents or damages. Theurel and Desbrosses (2019) underline that in fact one of the most crucial benefits of the introduction of digitalisation and automation is that it could handle the physical labour burden and ensure safety, protecting employees from work-related illnesses. Additionally, the results emphasise the need for the liner shipping company to continue investing in automation to secure an even safer working environment and infrastructure, while supporting efficiency, economic benefits, less working hours, working easier, reliability and forward thinking.

The main drawback underlined from the interviews and questionnaires is the fear of the employees that they might lose their job due to the existence of automation. Tarafdar et al. (2011) claim that this fear belongs under the umbrella of technostress and is one of the pain factors in employees' well-being. It is important for the liner shipping company to understand that although people are reluctant to change, yet they should prioritise explaining to employees that automation will secure their safety and that their work nature might change but they will not be unemployed. Additionally, a sense of reduced control over processes is identified as an issue, potentially leading to inefficiency response to malfunctions. Therefore, the liner shipping company should educate well trained professionals supervising the automated machines and securing the optimal port operations performance. As mentioned earlier, in a structured SMS and proactive risk assessment everyone would be fully trained on who to reach and how to report in cases of malfunctions.

Mousavi et al. (2017) highlight that the evaluation and analysis of risks in risk assessment helps in identification of various risks such as safety risks, financial risks or reputation risks. This need becomes more urgent when more automation is implemented in daily operations. As discussed before, according to the author's opinion a further implementation of automation would follow a stronger need of a more structured SMS and widespread risk assessment system

in the company. In general, we would say that in the context of SMS, which is very important for social sustainability, working towards automation increases the significance of risk assessment. Mousavi et al. (2017) support that the social aspect of safety is the first step of risk assessment, which includes the identification of risks by understanding the effects it has on people, information, financial measurements of the company and reputation. The results from the interviews and the questionnaires underline the need for the liner shipping company to include the employees in the changes to move towards a smoother transformation. Although the employees working in the port are afraid that automation might lead them to lose their job as their ways of working might become obsolete or that they will have to adjust to new ways of working, they still think that their employer will be a good employer if the company invests more in automation. Regarding the reputation to the customers, there is a general agreement that more automation will only bring beneficial outcomes as not only the company will appear as a better employer but also the orders will be delivered in time with less mistakes. In general, these outcomes underline the close correlation among automation, social sustainability and company's reputation, pinpointing the importance for the company to carefully manage the changes and include employees navigating through this transformation.

During the master thesis, the author of this thesis had always in mind that the level of safety management can affect both the safety feeling of the employees and as a consequence the reputation and the social sustainability, while at the same time the economic sustainability can be influenced since the absence of SMS might cause severe financial losses for a company. Except for social sustainability, the increasing implementation of automation and a further integration of SMS might be significant drivers of increase in economic sustainability within the liner shipping company. As Fernandez-Muniz et al. (2009) underline, one of the most important roles of SMS is the contribution in performance and economic indicators by effectively controlling risks. The author of this thesis believes that a further implementation of automation would help the liner shipping company to proactively manage the risks causing incidents, accidents and malfunctions leading to disruptions in the port operations. Possible incidents and accidents could result in negative activity outcomes and economic indicators. The information connected with the cost accompanying an accident or an incident could provide adequate data connecting with the benefits occurring from the control of the risks and crisis management provided by the SMS. The implementation of a SMS usually has the goal to reduce the direct and indirect costs connected with accidents/incidents and decrease the financial effects of missing SMS might have on a company. Mousavi et al. (2017) proved from

his diagram that accidents and malfunctions related to cargo loss, loss or injuring of human or other causes, lead to major delays in processes and can cause economic losses for a company. In this case, we are talking about improvement in performance and reduction in cost indicators as all employees will be working while maintaining productivity at the same levels with no mental or physical stress. At the same time there will be no disruptions in the port's operations leading to delays in deliveries, abnormalities in vessel planning, customer complaints, which will eventually lead to a reduction of economic changes occurring due to risks. The findings from the research are within the same frame, with the participants supporting that a further implementation of automation in port operations will have positive effects in cost indicators. As expressed by respondents, automation not only decreases the numbers of injuries, accidents and malfunctions, but also reshapes responsibilities, saving time and giving the space to the employees to focus on core tasks rather than administrative daily tasks.

According to the author of the thesis, the implementation of the automation will come with changes in the terminal's operations and infrastructure. As the literature underlines, the efficiency in port operations is significantly connected with the analysis of the terminal's infrastructure and cargo handling process, as they are strongly correlated to the transport and logistics systems (Carbone and De Martino, 2003; De Langen and Chouly, 2004). It is concluded that further automation is necessary to increase further the efficiency in port operations and processes followed in the terminal. Results from interviews and questionnaires support this conclusion as it is supported that a further automation influencing port activities, infrastructure and operations will lead to improved efficiency, for example driving experience in the port, while some changes such as path planning or blockchain support might be included. The thoughts for reduced manpower highlight the need for maintaining the employees proficient and fully capable in automated operation and new way of working, as well as new ways of customer interactions. Lastly, the changes in port operations and infrastructure will potentially create the necessity of further training to the employees both in how to handle the new processes but also how to manage malfunctions.

6.3 Methodological discussion

For this thesis the interpretivism paradigm was used, as this is described by Collis and Hussey (2014) and Blumberg et al. (2011). The main goal was to acquire an in-depth knowledge and interpretation of various social events avoiding the biassed individual opinion that could affect

the outcome of the research as much as possible. For this reason, the author of this thesis has decided to conduct a mixed method approach (Fusch et al, 2018), where the data were collected from qualitative and quantitative methods. It is important at this point to underline that due to the approaches followed the results of the case study should not be considered as the absolute truth but should be perceived as the best explanation. The data were collected via interviews, questionnaires and limited observations in some processes. Benefits resulting from the triangulation are connected with the increase of the reliability as we are having multiple sources of data to analyse and reach conclusions (Fusch et al, 2018).

Following the completion of the data collection and result analysis the author of this thesis had some comments on some improvements that could be made in future research if someone was to rerun the research. First and foremost, the COVID-19 timing of the research was not of a great help, something that delayed the research, did not give the opportunity to face to face interviews, and gave only limited access to the ports. Additionally, the original plan was after the distribution of the questionnaires to have further interviews with the participants to clarify some of their answers. It might have been an idea to separate the results from the questionnaires per responsible position. Unfortunately, this could not happen due to the restrictions existing. Hence, it is recommended that further analysis will be conducted on data to verify findings on this project.

7. Conclusions

In the conclusion chapter the research questions will be answered and explained further in a way to connect them with the study's purpose. Additionally, future research and future recommendations are added at the end of the thesis for future research.

During this research a thorough research has been taken on how safety is embraced in the liner shipping company in the Ro-Ro shipping segment. To answer the first research question "*What are the impacts of automation on the safety culture used by a liner shipping company?*", the author of this thesis wanted to get an in depth understanding of the safety culture existing currently in the company. The focus eventually was placed on the possibility of introducing a structured SMS and proactive risk assessment to maintain the company's efficiency and employees' safety after further automation implementation. The results highlight that these safety measures would not only boost employees' spirit and motivation, but also would be positive to the company's reputation and overall performance.

Investigating the movement towards further implementation of automation in the port operations would also answer the second research question, "*What are the economic and social impacts of automation on a liner shipping company*". In general, as the company moves towards digital transformation and automation of operations, it is important to implement a unified SMS and proactive risk assessment processes to ensure safety, maximise efficiency, productivity, and invest in economic sustainability. According to the results there is a connection among safety, automation, social sustainability, which indicates the importance of integrating and involving the employees during this transformation.

It is important to mention that the result does not want to propose that the liner shipping company should only focus on an implementation of a seamless SMS and proactive risk assessment process to ensure safety and efficiency, and maximum results in economic and social sustainability. According to the author of this thesis, the results should be used as basic information in future strategic decisions on how they should manage a situation where automation continuously transforms and/or increases, in order first to ensure safety for the employees and then to invest in the social and economic sustainability.

7.1 Practical implications

Reaching the completion of this thesis, the author would intend to propose some suggestions for further future research and development. First and foremost, the data from interviews and the questionnaires were collected during the period January to June 2021. Accordion to the author's knowledge after that period it was already scheduled some important changes to happen in Vlaardingen port, such as including gate infrastructure and location, and expanding of terminal. Having said that, it becomes obvious that automation is becoming a bigger part of businesses nowadays and it is of importance to gather new data when applicable to adjust the SMS and risk assessment accordingly.

One more suggestion is to try to categorise the results of the questionnaires according to job description. In this research the questionnaires were distributed to supervisors, foremen, stevedores, gate coordinators, employees in security, employee cross docking, trailer fitters, lashers and Tugmaster drivers aiming for a variety of replies. Nevertheless, the author of this thesis received answers back from employees working in the port as foreman, supervisors, gate coordinators and a surprisingly big number of replies received, compared to others, from Tugmaster drivers. For future research it would be interesting to collect questionnaires from a bigger sample of employees coordinated from a manager. It would be interesting to connect the results provided with the type of job each employee is doing and different types of risk they are exposed to.

7.2 Further research suggestions

A further suggestion for the further research is to include more terminals and analyse if the results match. This will not be easy as different terminals and countries follow different laws and legislations, but an idea would be to cluster countries based on similarities they have in their legislations and run again the same project. Multiple case studies would allow for further data analysis and probably in the future with the help of SMS would help to bridge the potential gaps.

A suggestion for further research is to conduct the same study in another part of the world, for example Far East. It would be interesting to investigate how different technological achievements, that are not be known to Europe yet, and differences in cultures might have an

influence to the result of this thesis. At the same time, different cultures have various timelines when it comes to automation and different approach to social and economic sustainability.

The author of this thesis suggests using the ladder theory to analyse the results of the interviews against the results of the questionnaires. It would be useful for the liner shipping company to practically view and compare if the idea the management team has about the safety is similar to what the employees working in port experience or feel in their daily work in the port. In fact, the author of this thesis believes that this should be a priority as the more automation will be installed the more the gap will grow.

Hazardous cargo requires a special handling in the terminal as it comes together with special legislations and regulatory compliance. When it comes to implementation of further automation, the hazardous cargo requires extra attention and knowledge of know to approach this topic and how to handle the cargo both on the terminal and eventual on the vessel safely. Hence, the author of this thesis believes that hazardous cargo should be included in for future research for researcher to have a clearer view of the whole supply chain.

Last but not least, a suggestion for future research is to conduct a quantitative data driven research and compare the safety on Ro-Ro terminals against container terminals. From the research conducted for this master thesis, it became clear to the author that the container terminals, for example the Hutchison Ports ECT Euromax in the Netherlands, are already ahead in the essence of automation offering a high level of safety. Given the fact that automation is constantly improving in Ro-Ro terminals, it would be interesting to continuously collecting ideas from container terminals.

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Appendix I

Interview Guide

Handling of information:

(The goal of this introduction section is for the interviewer to create a feeling of comfort and confidentiality to the respondent regarding the way their personal information and answers will be handled.)

- You as a person will maintain anonymity both during this interview and the analysis of the data. This means that the information gathered during this interview will be reviewed and analysed only by the interviewer.
- Is it ok to record this interview? The recorded interview will be used by me only to review and analyse the answers. No information will be communicated to other persons. The interviewer will not share or reproduce in public the record.
- Is it ok if some of the information provided by you used as comments in this master thesis or for further investigation?
- Analysed transcriptions of conducted interviews will be sent to you for confirmation.

Briefing:

(The goal of this set of questions is for the interviewee to in depth understand the meaning of this study and how this study might influence their quality of work in a positive way in future terms.)

- Presentation of myself and brief description of the study.
- Present to the interviewee the structure of the interview.

General information:

(The goal of this set of questions is for the interviewer to classify the respondent based on their background/experience and the country they work in, and continue the interview accordingly.)

- In which country/region do you work in?
- What is your current position?
- How many years do you work in this, or similar, positions?

Safety management culture:

(The goal of this set of questions is for the interviewer to framework the safety management culture at a liner shipping company.)

- Do you know if the company has any safety management system? If yes, please describe.
- Would you say that an implementation of a safety management system in a port terminal would influence the terminal's efficiency?
- Do you perceive the risk assessment (recognition and rating of risks) as a management tool of decision helping making processes in your work? If yes, in which ways?
- If you have experienced any accident/incident in your working environment, can you please describe it?
- Have you ever experienced disruptions in port's operations due to an occurrence of an incident/accident?
    - Yes
    - No
- Have you experienced a fluctuation of working motivation when an incident/accident occurs in a port terminal? If yes, can you tell me a little bit more about the consequences of it (i.e impact on time, money, reputation)?
- How often do you have training regarding safety in port?
    - Every 1 year
    - Every 5 years
    - Every 10 years
- Would you say that people working on site feel welcomed to give feedback regarding safety in the working conditions they experience during their everyday work? If yes, could you please describe?
- How would you describe the safety procedures people working in the port should follow in their daily work? Are all employees trained in these procedures?

Automation:

(The goal of this set of questions is for the interviewer to investigate both how respondents think automation might affect the way of working and what might be the impact in the safety management system.)

(To answer the questions below please consider as automation examples like;
i) camera system in gates that takes pictures of the units gating in making sure to verify whether the unit was damaged before entering
ii) LOT trestles; locked to the trailer while standing on the deck, less lashing, no need to manually position the trestles and the possibility to pre-trestle trailers
iii) SAT trestles; locking into the deck which will in most cases avoid the lashing of the trailer
iv) Terminal Management system (GTMS); automated system provide a place number to park the trailer after entering the gate)

- In which part of the daily work in port do you recognise the existence of automation?
- Would you suggest that automation could exist in more parts in the port terminal?
- What would you say are the advantages and disadvantages that an extended existence of automation in port would bring in the daily work procedures?
- How would you say automation might influence the safety procedures followed today in the port?
- How would you say automation might impact the cost indicators for the company?
- How would you say the company's reputation might be influenced by the introduction of automation?
- How would you say that the introduction of automation would affect the terminal's infrastructure and operations?

Appendix II

Questionnaire

Handling of information:

- You as a person will maintain anonymity during the analysis of the data. This means that the information gathered via this questionnaire will be reviewed and analysed only by the researcher.
- Follow up interviews might be necessary to be holded in case the questionnaire is not sufficiently completed, or further information is of interest for the researcher.

- Is it ok if some of the information provided by you, used as comments in this project for further investigation?
    - Yes
    - No

General information:

- In which location do you work? _____
- What is your current job title?
    - Supervisor
    - Foreman
    - Stevedore
    - Gate Coordinator
    - Security
    - Employee Crossdock
    - Trailer Fitter
    - Lasher
    - Tugmaster Driver

Safety management culture:

- How safe would you say you feel during your work in port?
    - 1 - very unsafe
    - 2 - unsafe
    - 3 - mostly safe
    - 4 - safe
    - 5 - very safe
- Have you ever experienced any accident while working in the terminal?
    - Yes
    - No
- How would you say an incident/accident in your working environment might affect your working motivation? Please choose a number among 1 to 5 (1-not at all affected, 5- very affected)
    - 1
    - 2

    - 3
    - 4
    - 5
- Have you ever experienced disruptions in port's operations due to an occurrence of an incident/accident?
    - Yes
    - No
- Do you believe that you have received enough training to carry out your work at the terminal safely?
    - Yes
    - No
- If you have received any kind of training regarding safety in port, what type of training did you participate in? _____
- Which procedure should you follow/ who should you contact to give feedback regarding safety in the working conditions you experience during your everyday work? _____
- Please describe briefly the safety routines/safety norms that you should follow in your daily work? _____
- How would you say the terminal's efficiency would be influenced by the existence of a system that would improve the health and safety and secure safety in the working environment?
    - Yes , it will be affected in a **positive way**
    - Yes, it will be affected in a **negative way**
    - It will **not be affected** at all

Automation:

(To answer the questions below please consider as automation examples like;

i) camera system in gates that takes pictures of the units gating in making sure to verify whether the unit was damaged before entering

ii) LOT trestles ; locked to the trailer while standing on the deck, less lashing, no need to manually position the trestles and the possibility to pre-trestle trailers

iii) SAT; locking into the deck which will in most cases avoid the lashing of the trailer

iv) Terminal Management system; automated system provide a place number to park the trailer after entering the gate)

- Where do you see, use or receive help from automation/ technical innovation or automated processes in your daily work? _____
- Which parts of your everyday work could be automated to make it easier, safer and more efficient? _____
- What would you say are the advantages and disadvantages the existence of automation/ technical innovation in port would bring in your daily work routines?
    - Advantages _____
    - Disadvantages _____
- Do you think the safety of your daily work in the terminal will change by using automation/ technical innovation? If yes, in which ways?_____
- Do you believe that your day-to-day work will become more efficient through automation/technical innovation or automated processes? If yes, in what way?_____
- How would you say the company's reputation (both among employees and market) might be influenced by the introduction of automation? _____
- Do you think that the liner shipping company will be a better employer if it invests in more automation/ technical innovation or automated processes at the terminal to make work easier?
    - Yes
    - No
- How do you think more automation/ technical innovation would impact the terminal's activities/ infrastructure and operations? _____

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