University College of Southeast Norway

TIMELINESS AND ACCURACY OF INFORMATION SHARING WITHIN A DRY-BULK SHIP OWNING COMPANY

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Abstract

This thesis has evaluated the timeliness and accuracy of cargo information perceived by the information sharers, ship crews and onshore workers. The research was conducted to see if the impropper balance of information sharing stated by International Maritime Organisation (IMO) could be perceived to exist within a dry-bulk ship owning company operating from the West coast of Norway.

The research was conducted by using a questionnaire in combination with an interview before and after the research to gain knowledge about the participants' attitude towards sharing cargo information within the company. The result of this research indicates that there is less of a difference between ship crews and onshore workers than presumed by prior research.

Key words: e-navigation, information sharing, information sharing barriers

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Introduction

The Demand and Need For Increased Information Sharing

In todays global market there is a demand for faster trading cycles, just-in-time delivery, and the need to respond to highly competitive market entrants (Branch & Robarts, 2014). As a part of the value chain delivering the cargo for their customers there is an increasing demand for efficiency, flexibility and reliability within shipping (DNV GL, 2014). At the same time the International Maritime Organisation (IMO) has increased its demands for more safety and operational reporting. This has led to higher demands for information shared to be more accurate, relevant, timely, and at the same time should benefit the company commercially (IMO, 2009).

Increased focus on information sharing has the possibility to bring a substantial amount of advantages to a company, such as: cost reduction, better use of resources, increased organizational productivity and efficiency, early problem detection, reduction of uncertainties, avoiding bullwhip effect, improved service, create and strengthen network, reduced cycle time, better tracing and tracking, and better use of organisation´s capacity (Grammenos, 2010; Lotfi, Mukhtar, Sahran, & Zadeh, 2013; Riege, 2005). Showing that the increased demand for information sharing can be seen more as an opportunity to profit from than a challenge to struggle with.

Shipping has a geographically dispersed work environment that is increasingly complex and has greater needs for quick and efficient decision-making, therefore awareness of the company´s needs and resources becomes more important (Barua, Ravindran, & Whinston, 2007; Fei, 2011). Branch and Robarts (2014) mentions five factors that influence the nature of transporting cargo at sea: speed, frequency, reliability, cost, and quality.

Speed is important to the ship owner who desires to market his cargo against an accurate arrival date and avoid additional costs, in form of delay fees and high bunker consumption (Branch & Robarts, 2014). Being behind schedule forces the ship to increase speed and consume more fuel. If a ship is forced to increase speed from 11 knots to 14 knots, the amount of fuel used in a year will more than double (DNV GL, 2014).

Frequency of service is important when cargo can only be sold in small quantities at frequent intervals, such as perishable goods. Frequency is heavily linked up to reliability, which is the ship´s timeliness, meaning that the ship sails and arrives at the advertised time (Branch & Robarts, 2014). For a ship owner this is an essential requirement to be seen as a trusted and reliable supplier of sea transportation (Stopford, 2009). Since timeliness of the ship will have an effect on frequency of sailings it again will have an effect on the ship´s annual earnings (Branch & Robarts, 2014).

Cost is important for the saleability of the service of transporting cargo. Minimizing cost is mostly related to constraints such as total travel time, sailing distance between offloading ports, availability and waiting time in each port, bunker facilities along the route, and speed (Branch & Robarts, 2014; Talley, 2012). By keeping the freight percentage of the total value as low as possible the company can increase their competitive advantages and revenue (Branch & Robarts, 2014; Stopford, 2009).

The final factor, quality of service is especially important in the competitive world of shipping and international trade. Providing a reliable service for handling cargo and document efficiency (Branch & Robarts, 2014). Information technology (IT) systems has shown to play a major role here by reducing buffer time, reducing number of speed adjustments, and better weather routing (Vanem, 2014). Eventually reducing uncertainty and risk for the company.

E-navigation and Drivers for Increased Information Sharing

To answer the increasing demand for improving the ships service standards there has been a huge development in on-board technology within navigation and communication systems (IMO, 2009). Ship crews have never had more navigational support systems than they have today (Vanem, 2014). The problem is that these systems are neither fully integrated nor harmonised with existing technology (IMO, 2009; Vanem, 2014). This creates a need for proper balancing of information levels and workload on-board ships, as well as effective procedures for ship-to-shore communication and teamwork (Patraiko, Wake, & Weintrit, 2010).

IMO in 2006 stressed the need for an initiative to encounter this development and improve on the situation and created a new sub-committee called e-navigation (Patraiko et al., 2010):

> *"E-navigation is the harmonized collection, integration, exchange, presentation and analysis of marine information on board and ashore by electronic means to enhance berth-to-berth navigation and related services for safety and security at sea and protection of the marine environment (p. 15)."*

As a means to, among many other things, guide the research conducted within e-navigation IMO (2009) has created a list of strategic core objectives, seen in table 1. Patraiko et al. (2010) state that the success of e-navigation will rely heavily upon the proper application of the human element throughout its development and implementation. They further state that there are some major human elements that deserve further attention and research on an international basis to support the IMO`s e-navigation concept (Patraiko et al., 2010; Vanem, 2014).

The safety and efficiency of transport of cargo at sea will continue to rely on good decisions being made on an increasingly constant and reliable basis (Patraiko et al., 2010). We might depend more and more on technology, but at a certain level we will always have to count on good human decisions being made. For this reason a great deal of effort needs to be made to understand the human element at all stages of design, development, implementation and operation of e-navigation (Patraiko et al., 2010).

Table 1

Core Objectives of e-navigation

The core objectives of the e-navigation concept are to:
1. Facilitate safe and secure navigation of ships having regard to hydrographical, meteorological and navigational information and risks
2. Facilitate ship traffic observation and management from shore/coastal facilities, where appropriate
3. Facilitate communications, including data exchange, among ship to ship, ship to shore, shore to ship, shore to shore and other users
4. Provide opportunities for improving the efficiency of transport and logistics
5. Support the effective operation of contingency response, and search and rescue services
6. Demonstrate defined levels of accuracy, integrity and continuity appropriate to a safety-critical system
7. Integrate and present information on board and ashore through a human-machine interface which maximizes navigational safety benefits and minimizes any risks of confusion or misinterpretation on the part of the user
8. Integrate and present information on-board and ashore to manage the workload of the users, while also motivating and engaging the user and supporting decision-making
9. Incorporate training and familiarization requirements for the users throughout the development and implementation process;
10. Facilitate global coverage, consistent standards and arrangements, and mutual compatibility and interoperability of equipment, systems, symbology and operational procedures, so as to avoid potential conflicts between users; and
11. Support scalability, to facilitate use by all potential maritime users.

Source: (IMO, 2009, p. 3)

By looking at the way a ship owning company shares information between ship and onshore office one can test to see what affects that information sharing and create strategies to tackle these hindrances. This contributes to better facilitate information sharing and at the same time improve the efficiency of the company.

This can be directly linked to the third and fourth core objectives of e-navigation, seen in table 1. Third core objective of the e-navigation indicates that there is a need to research the current ways of exchanging data, here called information sharing, to see if it needs improvements. Improving upon the current situation is directly linked to the fourth core objective, since improving a company´s information sharing will, as seen above, increase company´s efficiency.

Literature Review

Information Shared Between a Ship and Its Stakeholders

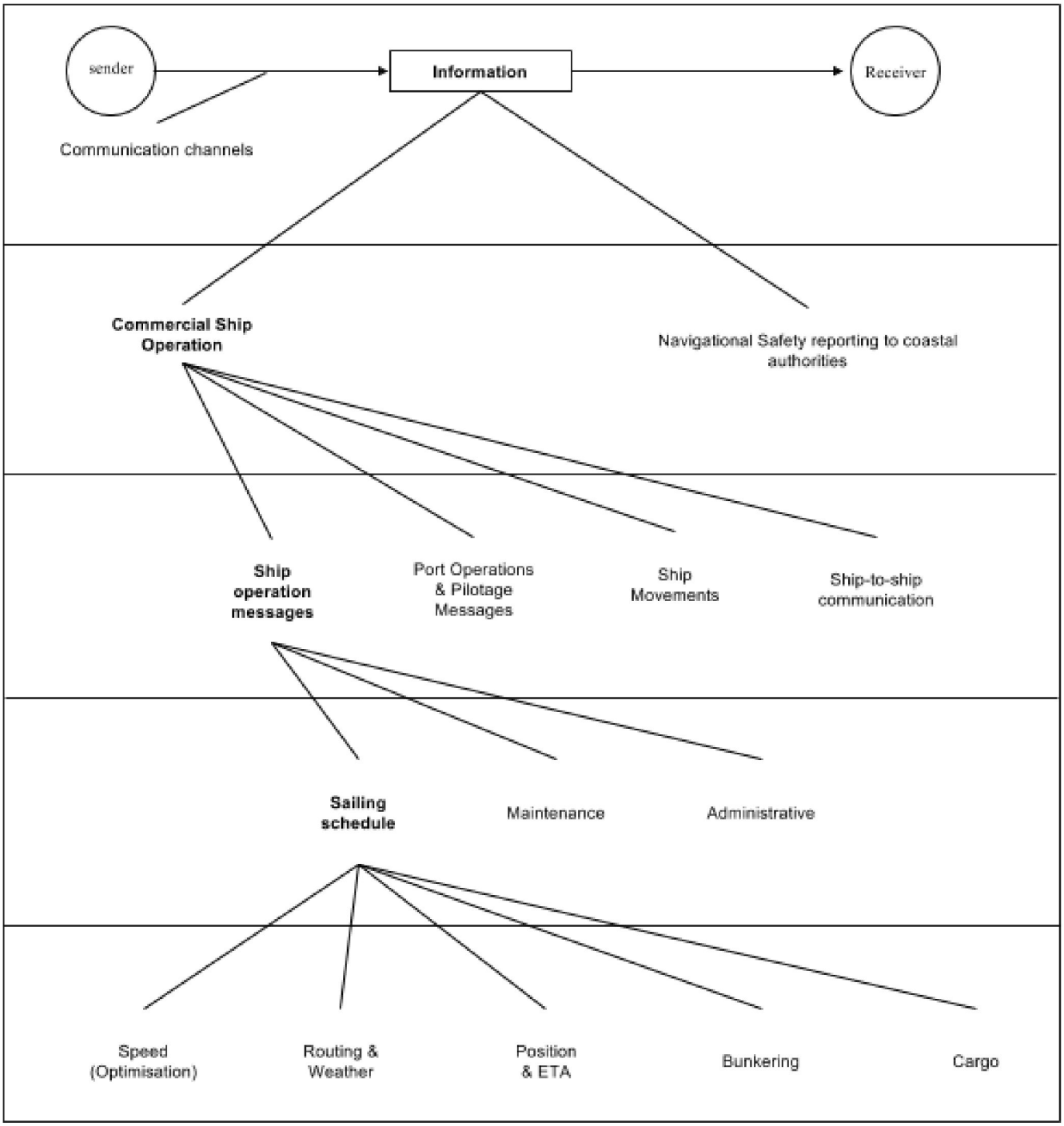
Information can be seen as any data that can be shared about anything (Merriam-Webster, 2015). Therefore, for the purpose of this thesis figure 1 has been created to illustrate the certain types of information that is shared between a ship and it´s stakeholders, and to show which part of the information chain this thesis has focused on.

The information being shared between ship and it´s stakeholders can be divided into two main groups: commercial ship operation information and navigational safety reporting to coastal authorities (Alderton, 2011). Distinguishing between these two is important to show the difference between information sharing enforced by regulations, and information sharing in the service of the transportation of commercial cargo (Alderton, 2011). This thesis focuses on the sharing of information between ship and onshore office within the same company,

therefore has this thesis looked at information regarding commercial ship operation and not navigational safety reporting to coastal authorities.

Figure 1

Information Shared Between Ship and Stakeholders



Source: Self-constructed.

Following the lines from commercial ship operation information one can further divide the type of information shared into four categories: ship´s operation messages, port operations and pilotage messages, ship movements, and ship-to-ship communication, which all are linked to different communicational duties (Alderton, 2011; International Chambers of Shipping, 2007).

Ship movements information is shared via an automatic identification system (AIS), which broadcasts the current position of the ship continuously, not demanding any two way communication (Vanem, 2014). Ship-to-ship information sharing is mainly short messages regarding ship manoeuvring within a small geographical area and the onshore office is not a part of that information sharing. Port operations and pilot messages will be in the interest of the onshore office, but the information sharing is regarding what is happening then and there in the port and is seen as too detailed information (Alderton, 2011). Only one of the categories has a high degree of communication between ship and onshore office, Ship operation messages. This information concerns the routine jobs on-board and the well being of the ship, cargo, and crew (Alderton, 2011).

Ship operation messages can be further divided into three: Sailing schedule, maintenance, and administrative (Branch & Robarts, 2014; Stopford, 2009). All three are connected to the day-to-day running of the ship, example: manning, determining speed optimisation, or painting the funnel. Maintenance and administrative information mainly relates to wellness of crew and the floating capabilities of the ship, while sailing schedule information is regarding the current and future operations of the ship (Alderton, 2011). This is to optimize the use of the ship, because a ship that is laid up whether because of periodic maintenance, survey, or lack of job earns no money for the ship owning company (Branch & Robarts, 2014).

Sailing schedule information is also often updated or revised because of changes in plans caused by, for example, malfunctions or weather changes (Manuel, 2011). This shows that a research about the sharing of sailing schedule information can facilitate possibilities for improving the ship owning company´s information sharing capabilities (Fei, 2011). Looking at figure 1 and following down from sailing schedule there are five elements that have a great effect: Speed, routing & weather, position & estimated time of arrival (ETA), bunkering and cargo (Branch & Robarts, 2014; Perakis, 2010; Stopford, 2009; Talley, 2012).

Speed optimisation is important to accurately determine ship´s arrival time, with buffer time and fuel (bunkers) costs in focus (Branch & Robarts, 2014). Weather routing is used to avoid delays caused by unforeseen weather conditions and at the same time increase the safety of the crew and cargo by avoiding heavy weather (Pacheco & Soares, 2007). The position of the ship is always an important factor, as all other factors has to adjust accordingly (Branch & Robarts, 2014). Ship needs bunkers to operate, but the price for heavy fuel oil vary a lot around the world, so optimising when and where to bunker can save a lot of money for the ship owner (DNV GL, 2014). Last one is cargo, which determines when and where the ship is to sail (House, 2016). Ships can transport many types of different cargoes at once and each cargo will demand certain kind of handling equipment (House, 2016). Making it the main factor for determining the ship owning company´s costs and revenues (House, 2016).

Seen above there are many aspects of a ship´s sailing schedule that affects the efficiency of a ship. This thesis has not taken upon itself to determine what kind of information is more important to look at than other, seen that this will vary between the different ship owning companies. Therefore, this thesis will base it´s research on the information agreed upon during a preliminary interview with the ship owning company being researched, seen further down in the thesis.

Further it should be stated that there are no lines clearly distinguishing the different categories stated in figure 1 from each other, it is unavoidable as most operations of a ship are heavily intertwined.

Information Sharing

Lotfi et al. (2013) defines information sharing as distributing useful information for systems, people, or organization units, while Li and Lin (2006) state that information sharing refers to the extent to which critical and proprietary information is communicated to one´s business partners. No matter the boundaries of to whom we share information with, it is seen as an important factor in the modern business world and a competitive advantage of a company (Barua et al., 2007; Coakes, Coakes, & Rosenberg, 2008; DNV GL, 2014; Li & Lin, 2006; Lotfi et al., 2013). This thesis focuses on the information sharing between two groups within the same company, so this thesis can be seen as a part of both definitions.

Quality Aspects of Information Sharing

Before conducting a research about information sharing one has to determine the different quality aspects of information sharing (Li & Lin, 2006). By having an understanding of the quality aspects a strategy can be developed to overcome barriers preventing information from being shared and at the same time encourage increased information sharing (Li, Ragu-Nathan, Ragu-Nathan, & Subba Rao, 2006).

Quality is a widely used word with many definitions and aspects attached to it depending on field of study. For this thesis quality will be seen in connection to information sharing and will use Li et al. (2006) definition of quality of information sharing: *" ...the accuracy, timeliness, adequacy, and credibility of information exchanged" (p. 621).*

Credibility. The credibility of information sharing is linked to the person sharing the information (Simpson & Prusak, 1995). Michnik and Lo (2009) defines credibility as the reputation and believability of the sender. Credibility will always have a powerful influence over the sharing of information (Li et al., 2006). Especially in a decision making environment of rapid change, such as shipping. With many influencing factors and forces there is often little time left to second guess the information received (Simpson & Prusak, 1995). Therefore, by obtaining a high credibility one would assist greatly in an already stressful environment (Wang & Strong, 1996).

Adequacy. Adequacy of information is seen as the ease of understanding the information being shared, meaning that the information is clear and comprehensive without any ambiguity (Ayadi, Cheikhrouhou, & Masmoudi, 2013). Challenges with adequacy of information sharing can often be found in organisations with diversified cultures, such as ship owning companies (Coakes et al., 2008; Fei, 2011). This is often intensified when subcultures exist within the organisation´s own culture, such as ship crew, having different purposes for the operation of the ship and operate from different geographical locations, leading to challenges in coordinated and productive information sharing (Coakes et al., 2008; Fei, 2011; Hatala & Lutta, 2009; Riege, 2005).

Timeliness.Within literature pertaining information sharing there are two contextual definitions of timeliness. Kahn, Strong, and Wang (2002, p. 187) define timeliness as *"the extent to which the information is sufficiently up-to date for the task in hand"*, while Michnik and Lo (2009, p. 852) define timeliness as *"coming early or at the right time."* For the purpose of this thesis the latter of the two definitions was determined more appropriate to use.

Delay in information sharing can often cause a bullwhip effect, where a delayed message can cause larger delays later down the line (Lotfi et al., 2013). Awareness of quick

relay of information to those who need it can improve resource utilization, increase efficiency, improve service, and reduce costs (Lotfi et al., 2013). For example, delayed reporting of change in ETA could cause company being charged for unnecessary preparing of dock, pilot service stand by, and have to wait for new available port time slot (Alderton, 2011).

Accuracy. Stating that accuracy is defined here as freedom from mistake or error (Michnik & Lo, 2009), so timely sharing of information will not be enough to assure the advantages mentioned earlier. Without a high degree of accuracy the information sent could cause uncertainty, misconduct during operations and reduce efficiency (Li, Rao, Ragu-Nathan, & Ragu-Nathan, 2005).

Sharing inaccurate information can cause decrease in fleet utility and high commercial losses (Branch & Robarts, 2014; Fei, 2011). Sharing, for example, the wrong ETA could cause management to demand increase in speed, which was shown about to have high economical consequences for the company. As mentioned earlier, a speed increase of 3 knots can increase the bunkers consumption with more than double (DNV GL, 2014).

Focus of this thesis. In an environment of rapid change, such as shipping, the timeliness and accuracy of information sharing can be seen as the two most important quality aspects (Li & Lin, 2006; Michnik & Lo, 2009; Simpson & Prusak, 1995). Therefore, as a means to narrow in the focus of this thesis and create a boundary for the research, these two quality aspects have been chosen to be the main focus for the rest of this thesis.

After identifying the different quality aspects of information sharing focused upon in this thesis different barriers that can affect these quality aspects was explored. Identifying different barriers influencing the sharing of information will greatly assist the company in the process of building information sharing strategies, so that the information sharing can become

more robust and maintain a continuous high degree of efficiency (Khurana, Mishra, & Singh, 2011; Riege, 2005).

Barriers Affecting Timeliness and Accuracy of Information Sharing

Some major barriers that affect the timeliness and accuracy of information sharing within a ship owning company were identified by linking well cited research about information sharing barriers with relative maritime literature. Both Khurana et al. (2011) and Riege (2005) have conducted some well cited research about barriers within information sharing that this thesis bases its barriers upon. The barriers are summarised into two tables found below, under each respective quality aspect.

Barriers affecting timeliness. As stated earlier, timeliness is doing something without delay (Michnik & Lo, 2009). In todays world, technological information systems are crucial to answer the worlds high demands for fast information sharing (Khurana et al., 2011). Incompatibility of information systems with process functions can act as a bottleneck to information sharing (Barua et al., 2007; Durugbo, Tiwari, & Alcock, 2013; Khurana et al., 2011; Riege, 2005). Durugbo et al. (2013) argue that this can result in inflexibility and sub-optimal information sharing, which will lead to further delays and miscommunication. One of IMO`s (2005) reasons for initiating the e-navigation was the fear that this is the path ships are heading towards if nothing is done with the continuous upgrading of unsynchronized systems.

Due to the remoteness of the onboard workplace, IT systems has been a great contribution to facilitate better and faster information sharing between ship and onshore office (Fei, 2011). No technical systems seem to come without any form of hitches (Riege, 2005). In the new era of IT systems on-board, ships lack of technical support for maintenance of IT systems has the possibility of becoming a real threat (Fei, 2011; Khurana et al., 2011; Riege,

2005). With the lack of technical support fixing IT problems can easily become frustrating and time consuming (Riege, 2005). This is an increasing threat for ships since they more and more heavily depend on IT systems to operate (Patraiko et al., 2010).

Not only the IT systems themselves can cause problems for the information sharing within the company. Research show that individuals willingness to share information due to lack of familiarity and experience with IT systems can cause disruption in the flow of information (Barua et al., 2007; Hatala & Lutta, 2009; Lotfi et al., 2013; Raban & Rafaeli, 2007; Riege, 2005). Especially when sharing information between two geographically dispersed locations (Fei, 2011). Adding that this will depend on how sophisticated and complex the system is (Khurana et al., 2011).

Sophisticated and complex technology for information sharing can be linked to the barrier above, implying that more sophisticated and complex systems will demand more training and first hand usage (IMO, 2005; Khurana et al., 2011; Riege, 2005). IMO (2005) has stated that the technology race is about to go over-board and there is a need for standarization and uniformity between the many systems on-board. Sophisticated and complex IT systems can even cause willing users to struggle with extracting and sharing important information, which leads to counter productivity (Khurana et al., 2011).

Having too much information has been proven to confuse and distract the decision makers (Khurana et al., 2011; Patraiko et al., 2010). Ship crews have so many different systems to gather information from creating the possibility of having too much information causing gathering and reporting of information dreary and confusing (Patraiko et al., 2010).

Combining the technological development on-board ships with the fact that there is an increase in fatigue caused by reduction of crew members cannot only be seen as a barrier for

information sharing but also as a real threat to navigational and environmental safety (Louie & Doolen, 2007; Uğurlu, 2016).

In fast paced or tight scheduled work environments general lack of time to share information is a high possibility and can cause a ripple effect of delays (Khurana et al., 2011; Riege, 2005). Ships are often viewed as short staffed and having tight daily shifts (Fei, Chen, & Chen, 2006; Talley, 2012), so to have many more important jobs on-board the ship than sharing information there is a descent possibility that ship crew would have general lack of time to share information (Fei et al., 2006).

With difference in work responsibilities and information needed to fulfil ones duties there can often be a problem with not noticing the importance of gathered information to others (Manuel, 2011). This can be linked to the general lack of time to share information, seen as this also causes a ripple effect were information gets delayed at all stages along the chain (Barua et al., 2007; Coakes et al., 2008; Fei, 2011; Manuel, 2011; Riege, 2005). The delayed relay of information caused by low awareness and realisation of the value and benefit of possessed information to others can therefore be seen as an information sharing barrier (Barua et al., 2007; Coakes et al., 2008; Fei, 2011; Riege, 2005).

In research focusing on geographical centred locations hierarchical organisation structure have shown to inhibit or slow down most sharing practices (Allen, James, & Gamlen, 2007; Coakes et al., 2008; Hatala & Lutta, 2009; Raban & Rafaeli, 2007; Riege, 2005). As stated earlier, ship owning companies are geographically disperced with onshore offices one place and ships spread around and moving all over the world (Branch & Robarts, 2014). This has created a situation where there are two different types of hierarchal structures. On-board most ships there is a clear top-down hierarchy (Theotokas, Lagoudis, & Kotsiopoulos, 2014), while the onshore shipping offices are known to have a flatter

organisational structure (Fei, 2011; Manuel, 2011). This creates an atmosphere where there is expected to have two very different perception of the organisations structure and its affect on information sharing (Fei, 2011).

Table 2

Barriers Affecting Timeliness of Information Sharing

Barriers	**References**
Incompatibility of information system with process functions	(Barua et al., 2007; Durugbo et al., 2013; Khurana et al., 2011; Riege, 2005).
Lack of technical support for maintenance of IT systems	(Fei, 2011; Khurana et al., 2011; Riege, 2005)
Reluctance to use IT systems due to lack of familiarity and experience	(Barua et al., 2007; Hatala & Lutta, 2009; Lotfi et al., 2013; Raban & Rafaeli, 2007; Riege, 2005).
Sophisticated and complex technology for information sharing	(IMO, 2005; Khurana et al., 2011; Riege, 2005)
Information overload for gathering and reporting information	(Khurana et al., 2011; Patraiko et al., 2010)
General lack of time to share information	(Khurana et al., 2011; Riege, 2005)
Low awareness and realization of the value and benefit of possessed knowledge to others	(Barua et al., 2007; Coakes et al., 2008; Fei, 2011; Manuel, 2011; Riege, 2005)
Hierarchal organization structure inhibits or slows down most sharing practices	(Allen et al., 2007; Coakes et al., 2008; Hatala & Lutta, 2009; Raban & Rafaeli, 2007; Riege, 2005)

Barriers affecting accuracy. Seen under quality aspects of information sharing accuracy was defined as freedom from mistake or error (Michnik & Lo, 2009). Managing that within an

industry like shipping demands a lot of effort, stating that shipping is alleged to be the most international industry in the world (Stopford, 2009).

Crew and onshore workers rarely have the same cultural background, which has been known to make daily information sharing demanding (Fei et al., 2006). Even though there is a universal working language within shipping, the ability to communicate varies considerably among seafarers (Fei et al., 2006). Marschan-Piekkari, Welch, and Welch (1999) research show that information sharing across cultures frequently involves misunderstandings caused by language barriers. Similar findings made by Jarvenpaa and Staples (2000) pointing out that cultural differences also affect the amount of information shared.

Therefore, the complexity of the workplace with multicultural backgrounds and multiple languages in the shipping industry is seen as a major barrier for information sharing (Fei et al., 2006), indicating that workers different values, cultural and linguistic environment can be considered a barrier for information sharing (Hatala & Lutta, 2009; Khurana et al., 2011; Riege, 2005).

Poor verbal and written communication and interpersonal skills has proven to be a challenge in companies on a general basis (Hatala & Lutta, 2009; Riege, 2005), as well as in the education of seafarers (Sampson & Zhao, 2003; Weintrit & Neumann, 2011). The inability to communicate properly have a great affect on the process of sharing accurate information (Fei et al., 2006). Research has shown that there are tight links between verbal skills and a person´s creation of cognitive concepts, critical analysis, and logical argumentation (Fei et al., 2006). If information is not shared properly the information might get misunderstood or under estimated and cause reduced efficiency and worst of all reduce the safety on-board the ship (Sampson & Zhao, 2003). Demonstrating that poor verbal and

written communication and interpersonal skills is a barrier for information sharing (Hatala & Lutta, 2009; Riege, 2005).

Riege (2005) stresses the fact that not only cultural background could cause difficulties when it comes to understanding each other. Håvold (2005) tested difference in perception of safety across different occupations within a shipping company and evidence suggests that the concept of safety differs between the different occupations throughout the whole ship owning company. Suggesting that difference in education and experience also affects the workers perception of information sharing as well (Fei et al., 2006). This can cause sharers of information to focus on different information than what the other party needs to conduct their job (Riege, 2005). Therefore, there is reason to consider that this barrier can be linked to the low awareness and realisation of the value and benefit of possessed information to others barrier under timeliness.

As indicated earlier interpersonal skills play a big part in information sharing (Hatala & Lutta, 2009; Riege, 2005). Companies with geographically dispersed teams have shown to have challenges relating to lack of accuracy and credibility of information source between team members that are located at different locations (Coakes et al., 2008; Manuel, 2011). Coakes et al. (2008) claim that the lack of face-to-face communication creates difficulties in building trust between the communicators. Riege (2005) state that this can be intensified if cross-functional teams have to be located at separate geographical positions, as in shipping.

"Information sharing embeds the notion of willingness to share (Jarvenpaa & Staples, 2000, p. 130)." Khurana et al. (2011) state that individuals unsatisfied with the organisation can become reluctant or unwilling to share information. Constant, Kieler, and Sproull (1994) argue that most research on information sharing regards technology and personal skills and not the attitude towards sharing information. They suggest that a person's ability to share

information is related to a person´s attitude towards the company and co-workers. Constant et al. (1994) evidence suggests that facilitating for increased information sharing is not the only or the right way to improve upon the company´s information sharing, the attitudes of the workers sharing the information is just as important, if not more important. Jarvenpaa and Staples (2000) strengthen this statement by expanding Constant et al. (1994) research and concluded with the same suggestions. Further suggesting that a co-worker´s willingness to share information can be a barrier for information sharing (Khurana et al., 2011; Riege, 2005). It should also be mentioned that the barriers are not stand alone barriers, many of them are heavily linked and cannot exist alone.

Table 3

Barriers Affecting Accuracy of Information Sharing

Barriers	**References**
Different values, cultural and linguistic environment	(Hatala & Lutta, 2009; Khurana et al., 2011; Marschan-Piekkari et al., 1999; Riege, 2005)
Poor verbal/written communication and interpersonal skills	(Hatala & Lutta, 2009; Riege, 2005; Sampson & Zhao, 2003)
Difference in levels of education and experience of employee	(Fei et al., 2006; Håvold, 2005; Riege, 2005)
Lack of accuracy and credibility of information source	(Coakes et al., 2008; Manuel, 2011; Riege, 2005)
Reluctance by unsatisfied individuals to share information	(Constant et al., 1994; Jarvenpaa & Staples, 2000; Khurana et al., 2011; Riege, 2005)

Preliminary Interview With The Company

Stated earlier in the literature review the company was given the opportunity to suggest what kind of information this thesis was going to focus on by participating in a preliminary interview before commencing the research. An additional advantage was the possibility to

gain information from an insider about the information sharing practices of the company to better adjust the research to fit the case in hand (Edwards, 2010).

The interview followed a semi-structured interview guide and a presentation of the researcher and subject was given, seen in appendix C. During the interview the interviewee informed that most of the information shared between the onshore workers and the ship crews was shared via e-mail and that there were rarely any problems with communication on a regular basis. The interviewee further commented that the information shared is mostly related to the cargo being transported. Rest of the information is more one way communication, were either onshore workers with management inform ship what to do or ship giving daily situation reports.

Cargo information is shared daily two-three days before arriving in port, then information sharing increase during loading operations in port and then again shared on a daily basis up to two-three days after leaving port. During this period information needed could vary because of different cargos demands, delays caused by equipment failure or other malfunctions. For theses reasons the cargo information was determined to be the most interesting information to look at and was determined to be the main focus of this thesis.

Research Problem

IMO state that there is a need to improve upon the current situation for ship crews (Patraiko et al., 2010). Stating that to provide opportunities for improving the ship crews' situation one first has to figure out what the challenges are before one can do anything about them. IMO has created a list of core objectives of e-navigation, seen in table 1, indicating what they are focusing on. This thesis has focused upon the third and fourth core objectives

related to data exchange, or here information sharing, and looking for opportunities to improve the organisations efficiency.

Prior research conducted on working environment on-board ships and information sharing barriers indicate that there are many situations and conditions that can cause information sharing between ship and onshore office to be below optimal. Michnik and Lo (2009) and Simpson and Prusak (1995) suggests that in an environment of rapid change, such as shipping, the timeliness and accuracy of information sharing can be seen as its two most important quality aspects.

Therefore, the aim of this thesis was to evaluate the timeliness and accuracy of cargo information perceived by the information sharers, on-board the ship and in the onshore office. To see if the improper balance of information sharing stated by IMO could be perceived to exist within a dry-bulk ship owning company operating from the West coast of Norway, by looking at the timeliness and accuracy of information shared between ship crews and onshore workers.

Hypotheses

Onshore workers in a ship owning company are said to be like all other business people onshore (Fei, 2011), meaning they are not directly affected by the statements made by IMO. Therefore will onshore workers be expected to give a lower mean score than ship crew for both timeliness and accuracy. For that reason the onshore workers will be used as a counter part to test the statements made by IMO.

H1: ship crews will have a higher mean score for timeliness, than onshore workers.

H2: ship crews will have a higher mean score for accuracy, than onshore workers.

Method

Cross-Sectional Research Design

This thesis has used a questionnaire in combination with a preliminary interview and a post-result interview to gain knowledge about the participants' attitude towards sharing cargo information within the company. The focus has been on the information sharing between two groups, ship crew and onshore workers (Bryman & Bell, 2011; Denscombe, 2010).

The preliminary interview was conducted to shape the direction of the questionnaire, while the questionnaire was used to find evidence of patterns for the participants overall attitude towards cargo information sharing within the company, and the post-result interview to gain insight into why the participants answered like they did (McCutcheon & Meredith, 1993).

Participants

The participants were predefined into two groups: ship crew and onshore workers. Ship crew is represented by the shipmasters, since they are the ones communicating with the onshore workers about cargo information, while onshore workers are represented by the onshore operation team-members, since they all individually have contact with the shipmasters regarding cargo information.

Grouping participants. The shipmasters operate on two different types of dry-bulk ships with different sizes and different sailing patterns, but for the purpose of researching cargo information sharing these are seen as members of the same group (Scott, 2000). The same goes for the onshore operation team, even though they operate different ships with different objectives they are seen as members of the same team (Scott, 2000).

Sampling. The researcher was in contact with two members of the company throughout the research. These two members assisted in determining the possible candidates for participating in the research, distributing the questionnaire and following-up late respondents (Frankfort-Nachmias & Nachmias, 2008).

For ship crew they had to be a shipmaster and for onshore operation team they had to communicate with the ships regarding cargo on a regular basis. A predetermined total amount of participants that could conduct the questionnaire was set to 64, 34 shipmasters and 30 onshore operation team-members. All 64 received a mail asking them to participate in the research with the questionnaire attached.

Data Collection

Data was collected in three rounds. First a preliminary interview to get a perspective from one of the company members and assist in the creation of the questionnaire. Secondly, the questionnaire was sent out and collected pertaining the attitude towards the company´s cargo information sharing. Thirdly, a post-result interview was conducted as a step in the process of analyzing the results of the questionnaire.

Preliminary interview. Preliminary interview with a member of the company was conducted to gain a point of view from an insider about the research problem, so that the questionnaire could be improved upon before being distributed (Denscombe, 2010; Edwards, 2010). For this purpose a semi-structured interview was conducted (Denscombe, 2010). This way the interviewee was given the opportunity to be more flexible, come with ideas, and speak more widely on the issues raised by the researcher (Denscombe, 2010). This also gives interviewee the possibility to indicate additional issues the research should focus upon. The interview guide is attached in appendix C.

Questionnaire design. The questionnaire is divided into 3 parts: introduction with instructions on how to answer, statements about timeliness, and statements about accuracy. The introduction contained instructions on how to answer the questionnaire, as seen in appendix B. This was done to create awareness of the reason for conducting the questionnaire and reduce the uncertainty of how to answer it (Bryman & Bell, 2011; Denscombe, 2010).

The second part and third part are statements with a Likert scale as answering alternatives. The Likert scale consists of five alternatives: strongly disagree, disagree, uncertain, agree, and strongly agree (Likert, 1932). Maxell and Jacoby (1972) suggests for the purpose of reducing the number of participants answering "no opinion or uncertain" to use more alternatives to choose from. For this reason the scale used was increased to nine points by adding an extra point between each alternative, which can be seen in figure 2.

Figure 2
Questionnaire Example

Cargo information is delayed more than once a week because of more important work.

Strongly disagree		Disagree		No opinion or uncertain		Agree		Strongly agree
1	2	3	4	5	6	7	8	9

All 22 statements in the questionnaire are focusing on the barriers of information sharing described in the literature review and altered after the preliminary interview to better fit the case in hand. The overall structure of the statements can be found in appendix A.

Timeliness is seen to have eight major barriers attached to it, while accuracy have five. Many of these barriers were seen to have multiple reasons attached to them, so to better fit the questionnaire with theory certain barriers were divided into multiple statements. It should be stated that the barriers were seen as theory to create statements, not be the main focus of the

thesis, which are the quality aspects timeliness and accuracy. Therefore, it was not deemed necessary to create multiple statements for all barriers.

Post-result interview. As a means to facilitate the interpretation of the result an interview after the data collection was conducted (Bryman & Bell, 2011; Denscombe, 2010). In this way the research got a more practical approach to understand the underlaying reasons for participants answering (Denscombe, 2010).

The interviewee was shown a presentation with the difference between shipmasters and onshore operation team for each statement and given the possibility to comment upon each of them. After going through all the statements the interviewee was shown a diagram pertaining all statements with their overall mean for each group, seen under results in figure 3, and the researcher asked some follow up questions, seen in appendix C.

Ethical Considerations

This thesis was conducted in accordance with Denscombe´s (2010) ethical code. Company, questionnaire participants, and interviewee were all kept anonymous throughout the thesis. The interview process was carried out in an open and honest manner. Interviewee´s misinterpretation of interview guide was averted by elaboration of each question and the use of semi-structured interview giving space and time for discussion when needed.

All questionnaire participations were well informed about the subject material by an introduction letter sent out with the questionnaire, seen in appendix B, and all data collected have been given consent by the company to be used for this thesis. The research has been structured to comply with Norwegian laws and general business ethics. Intellectual property rights and copyrights are respected by giving appropriate acknowledgement to the originators.

Data Analysis

For the statistical analysis of data and for creation of various diagrams IBM´s Statistical Package for Social Sciences (SPSS) Version 23 was used. The analyses used in SPSS are scale reliability analysis (Cronbach´s alpha), descriptive statistics (Shapiro-Wilk test), and independent t-test. Disclosing that some statement scores were reversed, so all scores indicated the same thing: the higher the score the greater the possibility that there exists information sharing barriers within the company.

Reliability test. To test the internal reliability of the research conducted a Cronbach´s alpha analysis was conducted. This analysis is used to see if all statements intended to ask about the same aspect are in fact doing so (Gliem & Gliem, 2003). George and Mallery (2009) provide the following rules of thumb: >0.9 = Excellent, > 0.8 = Good, > 0.7 = Acceptable, > 0.6 = Questionable, > 0.5 = Poor, and < 0.5 = Unacceptable.

Normality test. Likert scale is defined as continuous data (Spector, 1992), for that reason a Shapiro-Wilk test was conducted to see if the data was normally distributed to determine the appropriate type of hypothesis test (Ghasemi & Zahediasl, 2012). The advantage of using Shapiro-Wilk is that it works well with small samples (<50) (Ghasemi & Zahediasl, 2012). Shapiro-Wilk shows that data comes from normally distributed population if the significance level (*p*-value) is >0.05 (Thode, 2002). Further it should be mentioned that researches with small sample sizes when using normality tests could have little power to reject the null hypothesis and pass normality tests (Öztuna, Elhan, & Tuccar, 2006).

Significance test. For testing the hypotheses and determining if there is a significant difference between ship crew and onshore workers an independent *t*-test was conducted. A *t*-test show that there is a significant difference if the *p* value is <0.05 and the null hypothesis can be rejected (Rice, 2006).

Since the hypotheses states that ship crews will have a higher mean score than onshore workers for both quality aspects (ship crews > onshore workers) a one-tailed *t*-test was conducted (Rosenthal, 1978). Elaborating that a positive mean difference shows that the result is consistent with direction of hypotheses, while negative mean difference shows that the result is in the opposite direction of the hypotheses (Rosenthal, 1978).

As a means to strengthen the findings of the t-test a Cohen´s *d* calculation was also carried out. Cohen´s *d* determines the effect size of the result by determining how large difference it is between the means (Cohen, 1992; Kenny, 1987). The effect size is determined by a scale from 0-∞, d =0.2 is small, d = 0.5 is medium, and d > 0.8 is large (Cohen, 1992).

Results

Internal Reliability Test: Cronbach´s Alpha

The internal reliability calculated in SPSS shows that both timeliness and accuracy has a more than acceptable Cronbach´s alpha, seen in table 6.

Table 4

Cronbach's Alpha Levels

Quality Aspects	Ship α	Onshore α
Timeliness	0.836	0.814
Accuracy	0.816	0.791

Note. α = Cronbach´s Alpha

Mean Difference

By adding the means of the different statements related to Timeliness and then to accuracy one can see that there is a difference in the means for each of the information sharing quality aspects.

Table 5

Mean Difference

Group	Mean Timeliness	Mean Accuracy	Total Mean
Ship	3.6899	3.7516	3.7095
Onshore	3.4222	3.4911	3.5714

Test of Normality

A criteria for using *t*-test is that the data is normally distributed. In this instance a Shapiro-Wilk test was used. The test need a score >0.05 to indicate that the data is normally distributed. Both timeliness and accuracy had a score of >0.05, seen in table 6 below. Indicating that both quality aspects can be seen as normally distributed. A further notice is that Lilliefors Corrected Kolmogorov-Smirnov test is generated at the same time as Shapiro-Wilk and that test also showed the same result, backing up the Shapiro-Wilk test.

Table 6

Tests of Normality

		Shapiro-Wilk		
	Group	Statistic	df	Sig.
Mean Timeliness	Ship	0,970	23	0,698
	Onshore	0,956	18	0,536
Mean Accuracy	Ship	0,952	23	0,322
	Onshore	0,924	18	0,387

Note. df = degree of freedom, sig. = significance level

T-test and Cohen´s *d*

The results of the independent *t*-test for timeliness was not significant, t (39) = 0.92, p = 0.18. Indicating that there is no significant difference between the ship crew (M = 3.69, SD = 0.99, n = 23) and the onshore workers (M = 3.42, SD = 0.84, n = 18). The 95% confidence interval for the difference between the means was -0.32 to 0.86. The effect size indicated by Cohen´s *d* (0.29) was small. The researcher fails to reject the H1 null hypothesis.

The same results can be found in the independent *t*-test for accuracy, it was not significant, t (39) = 0.43, p = 0.34. Indicating that there is no significant difference between the ship crew (M = 3.75, SD = 1.45, n = 23) and the onshore workers (M = 3.57, SD = 1.18, n = 18). The 95% confidence interval for the difference between the means was -0.67 to 1.03. The effect size indicated by Cohen´s *d* (0.14) was small. The researcher fails to reject the H2 null hypothesis, as well.

T-test With Bonferroni Correction and Cohen´s *d* For Each Statement

The analyses above shows that both null hypotheses cannot be rejected. Therefore, as a means to further analyse where the differences between the two groups are an additional round of *t*-tests was conducted for each statement.

By increasing the nr of *t*-test that is conducted the chance of getting at least one significant result increases (Hochberg, 1988; Holm, 1979). The possibility that one or more of these *t*-tests are falsely significant by chance is 68%, therefore was Bonferroni correction used to counter this phenomenon (Holm, 1979). Bonferroni adjusts the *p*-value criteria from 0,05 to 0.0022727 (Holm, 1979). Seen in table 7, illustrated, in figure 3 only one statement can be seen to have a significant difference with the Bonferroni correction, statement T14 (p = 0,000): Cargo information has to be approved by a higher-ranking officer before being shared.

Table 7

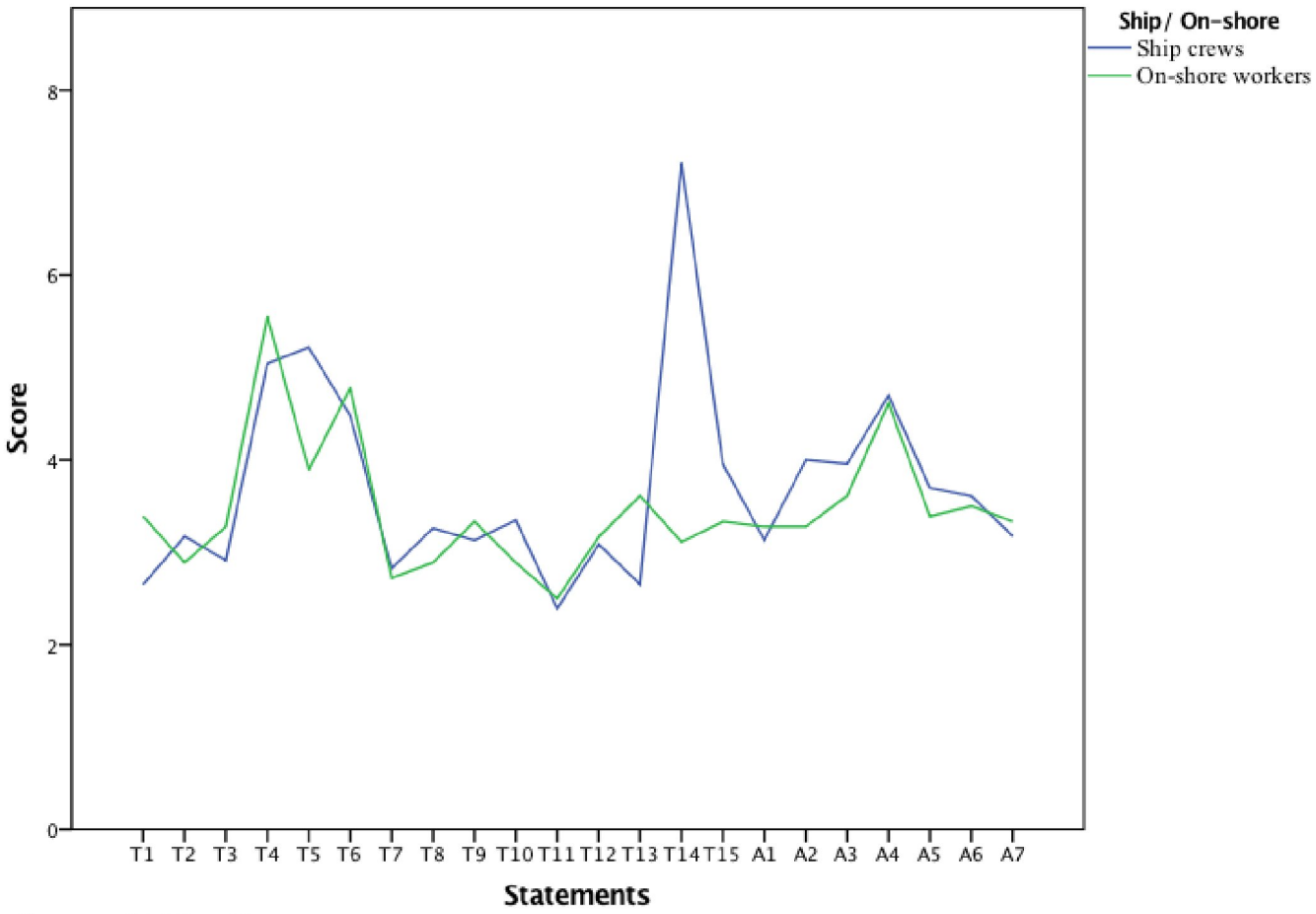
t-Test and Cohen´s *d* for Individual Statements

	Ship		Onshore				95% Confidence Interval of the Difference		
Statements	**Mean**	**St. D.**	**Mean**	**St. D.**	**Mean diff.**	***p*-value**	**Lower**	**Upper**	***d***
T1	2,65	0,832	3,39	0,850	-0,74	0,004	-1,271	-0,202	0,09
T2	3,17	1,800	2,89	1,323	0,29	0,289	-0,740	1,310	0,02
T3	2,91	1,593	3,28	1,526	-0,37	0,232	-1,360	0,631	0,02
T4	5,04	1,918	5,56	1,504	-0,51	0,179	-1,626	0,602	0,03
T5	5,22	2,044	3,89	1,937	1,33	0,021	0,057	2,600	0,07
T6	4,48	2,333	4,78	1,896	-0,30	0,331	-1,670	1,071	0,01
T7	2,83	2,125	2,72	1,487	0,10	0,431	-1,089	1,297	0,01
T8	3,26	1,864	2,89	1,491	0,37	0,247	-0,717	1,461	0,02
T9	3,13	1,687	3,33	1,572	-0,20	0,348	-1,245	0,840	0,01
T10	3,35	1,748	2,89	1,410	0,46	0,185	-0,565	1,483	0,03
T11	2,39	1,270	2,50	1,043	-0,11	0,386	-0,858	0,640	0,01
T12	3,09	1,905	3,17	2,093	-0,08	0,450	-1,346	1,187	0,00
T13	2,65	1,695	3,61	1,975	-0,96	0,051	-2,119	0,201	0,05
T14	**7,22**	**1,313**	**3,11**	**1,811**	**4,11**	**0,000**	**3,120**	**5,093**	**0,26**
T15	3,96	2,121	3,33	1,609	0,63	0,154	-0,595	1,842	0,03
A1	3,13	2,007	3,28	1,277	-0,15	0,393	-1,237	0,942	0,01
A2	4,00	2,111	3,28	1,841	0,72	0,129	-0,549	1,994	0,04
A3	3,96	1,665	3,61	1,914	0,35	0,271	-0,786	1,477	0,02
A4	4,70	2,141	4,61	2,004	0,09	0,449	-1,241	1,410	0,00
A5	3,70	2,363	3,39	1,685	0,31	0,322	-1,027	1,640	0,02
A6	3,61	2,350	3,50	1,917	0,11	0,436	-1,274	1,491	0,01
A7	3,17	1,946	3,33	1,680	-0,16	0,392	-1,327	1,009	0,01

Note. St. D. = standard deviation, *d* = Cohen´s *d*

Figure 3

Comparison of Mean Scores for All Statements



Source: SPSS v.23

Post-Result Interview

T1 and T2 were both seen upon as expected results. The interviewee explained that the organisation has a technical support team in-house; so positive scores were expected from onshore workers. The results from the Ship crew was also expected to be positive since cargo information is shared mostly via mail and all ships are equipped with more than one computer, so if one fails they have a backup to avoid any long delays.

The only discrepancy with statement T3 is that ship crew is more positive than onshore workers. The comment on the discrepancy by the interviewee was:

"Ship might have a greater acceptance that things go a bit slower than onshore team. We on shore are more demanding, especially the younger team members onshore, they have grown up with better technology and faster technology than is possible here. The ship crews are not used to that degree of technology and might see e-mail as high tech. It is natural that it is this way."

Statements T4 and T5 are two opposites of the same scale. Here the researcher tried to get an indication how high both groups rate their information sharing system up against other information systems. Both mean scores for ship crew indicated that they were quite neutral in their point of view of their information sharing system. Onshore workers showed a tendency to be a bit more negative. The interviewee believed that this is linked to the statements above that the younger generation onshore has more experience with more high tech equipment. The interviewee add:

"Both questions expect a pre knowledge that there exists better ways of sharing information and I am not sure if everybody at sea know about so many ways to share information. The systems we use now are very rarely down, and we have had nothing but positive feedback."

Statement T6 is about the organisations need for more training in using in-house communication devices, and showed a tendency for both groups pointing towards the middle of the scale. Only comment given about this result was: *"Quite surprising that both answered quite equal."*

For the next two statements, T7 and T8, the interviewee comments that the result speaks for it self and that the results are quite good for their part. For statement T9 the first comment came before looking at the results. The interviewee stated that these results might show a different situation than it actually is.

> *"I remember this question here, when I answered this question I thought to my self that the problem with this question is that it says 'more than once a week'. There is often a lot of information but it is not necessarily weekly, it comes in bulks and then it becomes too much. The difference between ship and onshore can easily be explained, ships have one trip and one cargo to focus on, but onshore we control around four ships and have then more cargo information to distribute. I recognize this situation very well. If you are on a ship and have a cargo problem you have one problem, if you are onshore and have a cargo problem you have up to four problems at once."*

The difference in results for statement T10 is quite clear for the interviewee. The most important task for the onshore workers is to share cargo information, while for the ship crew the most important task is to steer the ship. The interviewee finishes on the comment by stating: *"Taking care of port operations and many other duties comes first for ship crew and that is natural. I believe this easily explains the result to this question."*

Statement T11 was commented upon as not showing the actual situation. Interviewee states that: *"I don´t believe the ones at sea would dare answer anything else than what they did. Onshore workers most important work is to share cargo information so they are expected to give a low score here."*

For statement 12 there might be a discrepancy between the result and the actual situation. The interviewee again comments on the use of the phrase “more than once a week” in the statement. Interviewee says that information is delayed, but the occurrences where there is a lot to do that cause these delays happen less than weekly.

The interviewee states that the difference in answers for statement 13 is related to amount of information that the two different groups have to share. *“Ships have one cargo and have orders from onshore whom they should contact. Onshore have many ships, many cargoes and much more to have control over.”*

Seen in table 7, statement T14 is the only statement that can be shown to have a significant difference between the two groups. The ship crew showed to have the highest score by far. Interviewee stated that *“if this was not the result I would be very surprised,”* further elaborating, *“Ships have a clear hierarchy, onshore not so much*.”

The last timeliness statement, T15, shows an unexpected result for the interviewee. The company is commented on being big and that created the expectations that information sharing would be perceived to be slow. Interviewee comments that: *“I have to believe that our work to have a good information chain pays off. The chain between the decision-makers are short and that is shown in this result.”*

Statement A1 can also be seen to point in the opposite direction of what was expected from the interviewee:

> *“Would expect the opposite result, that ship would have a higher score than onshore. I would also expect that onshore would rate this much higher and see it as a barrier, since we talk about it as a barrier all the time at work.”*

For statements A2, A3, and A4 the interviewee proclaim that there is a high chance that these are all misunderstood. *"Here I believe that people would understand it differently since information change all the time. Wrong information sent or updated information are two ways this question can be understood. This one is difficult to comment on."* For statement A4 the interviewee adds: *"Information is updated so often, so not to make mistakes information is often double checked just to be certain."*

For statement A5 the interviewee is surprised to see such a good result. This statement is commented up against A1, which is also connected to the language skills of the employees: *"Again as the other language question I am surprised that it is not rated higher. The best thing is to have the same nationality all over, which would make the situation much easier."* The reason for the good result was never explicitly commented.

Statement A6 was only briefly touched upon during the interview and the interviewee gave only a comment about the natural difference in education between ship crew and onshore workers. The final statement, A7, was not given much time either. The interviewee commented by saying: *"If this questionnaire was not anonymous everyone would answer uncertain. That I can promise you."*

When asked if any final comments the interviewee had this to say:

> *"Impressive how equal they answer. They are more equal than one would think. This is good for the company… One could say that the research becomes less important when I see the result, if you found something that was troublesome my answer might have been different, for the topic overall is an important topic."*

Discussion

IMO has stated that there is a need for proper balancing of information levels and workload on-board ships, and effective procedures for ship-to-shore information sharing and team work (Patraiko et al., 2010). As a means to test this improper balance this thesis has reviewed two out of eleven core objectives: data exchange, here called information sharing, and opportunities to improve the company´s efficiency. This has been done by evaluating the timeliness and accuracy of information sharing within the company. Testing to see if information sharing barriers related to these quality aspects are perceived to affect the company´s internal information sharing.

Previous research suggests that information sharing barriers exist within companies but how much these barriers affect the companies information sharing depends upon the individual companies' strategies and structure (Khurana et al., 2011; Riege, 2005). Still some major concerns has been made for the shipping industry at large related to the compatibility between IT systems and human factors on-board ships (IMO, 2009; Patraiko et al., 2010).

The result of this thesis contradicts previous research, by failing to reject the null hypotheses. *T*-tests for both timeliness and accuracy show that there are no significant differences in perception between ship crews and onshore workers. Because of this result an additional round of *t*-tests were conducted to see if there were any significant differences between the groups on the individual statements.

Three statements showed a significant difference according to standard *t*-test criterion of p value <0.05, all related to timeliness. Considering the mean difference according to Rosenthal (1978), and adjusting the criterion for passing the *t*-test according with a Bonferroni correction there was only one statement that had a lower *p*-value ($p = <0.0022727$), statement T14 ($p = 0.000$) regarding hierarchy in the workplace (Holm, 1979).

Assisting to interpret the result a post-result interview with one member of the onshore operation team was conducted. The result from this interview shows that the statements related to timeliness were mostly as interviewee expected. However the interviewee commented that the there is a possibility that the wording on some of the statements have caused the participants to give lower scores than they would have if the time characteristic of the statement was more open. Following the fact that the groups share information less frequent than anticipated by the researcher.

When reviewing the result for statement T14 the interviewee showed no surprise over the result. Hierarchy on-board ships is a known fact, it is the way of life at sea (Alderton, 2011; Branch & Robarts, 2014; Dykstra, 2005; Fei et al., 2006; Theotokas et al., 2014). As the interviewee nicely put it *"Ships have a clear hierarchy, onshore not so much*." Therefore, this result can be seen more as an indication that both groups have answered the questionnaire thoroughly, not as a significant finding.

Seen with the interview the overall results for timeliness went against expectations according to previous research but in the same direction as the interviewee expected. Indicating that the company has a high focus on timeliness of information sharing and can be the reason for the good results.

For the accuracy statements the interviewee was more surprised by the results, at least for two of the statements related to language, mentioning that: *"we talk about it as a barrier all the time at work."* All the other statements under accuracy were also commented upon regarding the wording of the statements, some comments related to sensitive subjects and others for the possibility of multiple understandings of the subject in the statements, indicating that these results are more obscure.

Limitations of This Study

The five main limitations of this study are: sample size, questionnaire structure, interviews, reliability and validity.

Sample size. For most statistical tests and analyses there is a need for a large amount of participants. This thesis has had a case study approach to the research focusing on only one company and having a low amount of participants, total of 41 participants. This limitation was compensated for by using two methods to collect data, but it is still a great factor that needs to be commented upon (Bryman & Bell, 2011). The accuracy of the data gathered might give a different picture than the actual situation since the total population is so small all participants that did not answer the questionnaire, 23 of 64, would most likely shift the final result of the questionnaire. Reason for not collecting data from all possible participants is related to the long response time for collecting questionnaires.

Questionnaire structure. During the post-result interview there were some comments on the wording of the questionnaire. The interviewee commented that the wording "more than once a week" would give the wrong impression on the participants, since most situations where the questionnaire was relevant happens less than weekly. The wording on some of the accuracy statements were also commented upon, believing they were to a like and unclear to create a context to evaluate them within. Finally, the last statement was seen as to biased creating a situation where at least ship crew would feel uncomfortable answering truthfully.

Interviews. The interviews were conducted with only one from the onshore operation team. This causes a situation were only one participant from one group gets to give input prior to conducting the data collection and comment on the final result. An additional interview with ship crew group would have given a greater view of the whole picture and more insightful analysis and discussion of the results (McCutcheon & Meredith, 1993).

Reliability and validity. Cronbach´s alpha was used to determine reliability. The test is used in statistical analysis of data and give the best result with large amount of participants (Gliem & Gliem, 2003). Taking this under consideration there is a possibility that the Cronbach´s alpha gives a false positive. Further, the questionnaire is self-composed and the underlaying factor structure has not been tested, therefore its construct validity can be at risk. Stating that the construct validity is the degree to which the questionnaire measured what it was supposed to measure (Cronbach & Meehl, 1955). Peter (1981) suggests that construct validity cannot be proven or disproven with a single research or a single measure. Construct validity is better built by conducting continuous evaluations and improvements with multiple researches and multiple measures (Peter, 1981).

Further Research

This thesis found few differences between ship crews and onshore workers, so further research should be conducted to see if this is the case for other ship owning companies as well. In this way the need for e-navigation can be evaluated on a regional, continental and international basis. In addition, this opens the possibility of creating a benchmark and market standard assisting in the facilitation of and improving the overall information sharing within the industry. Here the researcher would recommend that the two quality aspects not researched in this thesis, Credibility and adequacy, are also included.

Further research can also test the findings of this thesis by observing the actual information sharing situation to see if information sharing barriers can be found by the use other research methods. The thesis can also be followed-up by conducting in-depth interviews with multiple participants or conduct a new questionnaire where real life examples are used to increase the participants understanding.

Conclusion

The findings from this evaluation of a dry-bulk ship owning company operating on the West coast of Norway indicate that the improper balance of information sharing stated by IMO could not be perceived to exist. Reasoned with the result from the research that found few differences between ship crews´ and onshore workers´ perception of timeliness and accuracy of information sharing within the company. Suggesting that the company need no additional facilitation for data exchange and that there is currently no need for improving company´s efficiency, related to information sharing.

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Appendix A

Table A1
Statements and Their Related Barriers and Quality Aspects

Quality aspects	Barriers	Statements	References
T	Incompatibility of information system with process functions	T1: The way we share cargo information is slow and difficult. T2: There are better ways of sharing cargo information than the way we do it. T3: There are worse ways of sharing cargo information than the way we do it.	(Barua et al., 2007; Durugbo et al., 2013; Khurana et al., 2011; Riege, 2005).
T	Lack of technical support for maintenance of IT systems	T4: I am satisfied with the technical support I receive. T5: There is more than once a week a delay in cargo information sharing because of delay in technical support.	(Fei, 2011; Khurana et al., 2011; Riege, 2005)
T	Reluctance to use IT systems due to lack of familiarity and experience	T6: There is a need for more training in the use of computer and voice communication devices. T7: I feel uncomfortable with using company´s communication devices.	(Barua et al., 2007; Hatala & Lutta, 2009; Lotfi et al., 2013; Raban & Rafaeli, 2007; Riege, 2005).
T	Sophisticated and complex technology for information sharing	T8: The communication devices/technology are too sophisticated and complex.	(IMO, 2005; Khurana et al., 2011; Riege, 2005)
T	Information overload for gathering and reporting information	T9: More than once a week I have a problem with too much information to know what cargo information to share.	(Khurana et al., 2011; Patraiko et al., 2010)
T	General lack of time to share information	T10: Cargo information is delayed more than once a week because of more important work. T11: I do not have time to share cargo information.	(Khurana et al., 2011; Riege, 2005)

T	Low awareness and realization of the value and benefit of possessed knowledge to others	T12: Cargo information that is important for my work is delayed more than once a week. T13: I always know whom I should share cargo information with.	(Barua et al., 2007; Coakes et al., 2008; Fei, 2011; Manuel, 2011; Riege, 2005)
T	Hierarchal organization structure inhibits or slows down most sharing practices	T14: Cargo information has to be approved by a higher-ranking officer before being shared. T15: The structure of organisation inhibits or slows down most sharing of cargo information.	(Allen et al., 2007; Coakes et al., 2008; Hatala & Lutta, 2009; Raban & Rafaeli, 2007; Riege, 2005)
A	Poor verbal/written communication and interpersonal skills	A1: Cargo information is more than once a week misunderstood because of bad/poor verbal or written communication.	(Hatala & Lutta, 2009; Khurana et al., 2011; Marschan-Piekkari et al., 1999; Riege, 2005)
A	Lack of accuracy and credibility of information source	A2: Cargo information has to be sent again more than once a week because information was wrong the first time. A3: Cargo information is often double checked because there is a lack of trust in sender accuracy. A4: Cargo information is more than once a week double-checked.	(Hatala & Lutta, 2009; Riege, 2005; Sampson & Zhao, 2003)
A	Different values, cultural and linguistic environment	A5: Differences in language skills cause misunderstandings more than once a week.	(Fei et al., 2006; Håvold, 2005; Riege, 2005)
A	Difference in levels of education and experience of employee	A6: Difference in levels of education and experience causes misunderstandings more than once a week.	(Coakes et al., 2008; Manuel, 2011; Riege, 2005)
A	Reluctance by unsatisfied individuals to share information	A7: There are unsatisfied individuals in the company that does not want to share information.	(Constant et al., 1994; Jarvenpaa & Staples, 2000; Khurana et al., 2011; Riege, 2005)

Appendix B

Questionnaire About Cargo Information Sharing Between Ship and Onshore Operation Team

Thank you for participating in this research project. The Questionnaire is a part of my master thesis regarding the demand for increased information sharing within shipping. By conducting this research I wish to look at the difference in perception between ship and onshore operation team regarding information sharing. By basing the research on a certain kind of information I want to give you something to focus on when answering the questionnaire.

The whole Questionnaire focuses on your opinion about the communication between ship and onshore operation team.

The questionnaire is anonymous; so do NOT include any name or identification mark.

Cargo information Means all information regarding the cargo.
Some examples are:
Type of cargo to be loaded, how much to load, how much was loaded, how should it be loaded, loading problems causing delays, how should it be stowed (stowage plan), how was it stowed, cargo reports, etc…

How to answer:

Draw a circle or a cross over the number that represents how much you agree with the statement.

1= Strongly disagree
2= In between strongly disagree and disagree
3= Disagree
4= In between disagree and no opinion or uncertain
5= No opinion or uncertain
6= In between no opinion or uncertain and agree
7= Agree
8= In between agree and strongly agree
9= Strongly agree

Example:

I am satisfied with the technical support I receive.

Strongly disagree		Disagree		No opinion or uncertain		Agree		Strongly agree
1	(2)	3	4	5	6	X 7	8	9

Best Regards and a warm thank you,
Erik Aleksander

Where do you work?

Ship OR onshore operation team

Part 1: Timely sharing of information

I am satisfied with the technical support I receive.

Strongly disagree		Disagree		No opinion or uncertain		Agree		Strongly agree
1	2	3	4	5	6	7	8	9

There is more than once a week a delay in cargo information sharing because of delay in technical support.

Strongly disagree		Disagree		No opinion or uncertain		Agree		Strongly agree
1	2	3	4	5	6	7	8	9

The way we share cargo information is slow and difficult.

Strongly disagree		Disagree		No opinion or uncertain		Agree		Strongly agree
1	2	3	4	5	6	7	8	9

There are better ways of sharing cargo information than the way we do it.

Strongly disagree		Disagree		No opinion or uncertain		Agree		Strongly agree
1	2	3	4	5	6	7	8	9

There are worse ways of sharing cargo information than the way we do it.

Strongly disagree		Disagree		No opinion or uncertain		Agree		Strongly agree
1	2	3	4	5	6	7	8	9

There is a need for more training in the use of computer and voice communication devices.

Strongly disagree		Disagree		No opinion or uncertain		Agree		Strongly agree
1	2	3	4	5	6	7	8	9

I feel uncomfortable with using company´s communication devices.

Strongly disagree		Disagree		No opinion or uncertain		Agree		Strongly agree
1	2	3	4	5	6	7	8	9

The communication devices/technology are too sophisticated and complex.

Strongly disagree		Disagree		No opinion or uncertain		Agree		Strongly agree
1	2	3	4	5	6	7	8	9

More than once a week I have a problem with too much information to know what cargo information to share.

Strongly disagree		Disagree		No opinion or uncertain		Agree		Strongly agree
1	2	3	4	5	6	7	8	9

Cargo information is delayed more than once a week because of more important work.

Strongly disagree		Disagree		No opinion or uncertain		Agree		Strongly agree
1	2	3	4	5	6	7	8	9

I do not have time to share cargo information.

Strongly disagree		Disagree		No opinion or uncertain		Agree		Strongly agree
1	2	3	4	5	6	7	8	9

Cargo information that is important for my work is delayed more than once a week.

Strongly disagree		Disagree		No opinion or uncertain		Agree		Strongly agree
1	2	3	4	5	6	7	8	9

I always know whom I should share cargo information with.

Strongly disagree		Disagree		No opinion or uncertain		Agree		Strongly agree
1	2	3	4	5	6	7	8	9

Cargo information has to be approved by a higher-ranking officer before being shared.

Strongly disagree		Disagree		No opinion or uncertain		Agree		Strongly agree
1	2	3	4	5	6	7	8	9

The structure of organisation inhibits or slows down most sharing of cargo information.

Strongly disagree		Disagree		No opinion or uncertain		Agree		Strongly agree
1	2	3	4	5	6	7	8	9

Part 2: Accuracy of shared information

Cargo information is more than once a week misunderstood because of bad/poor verbal or written communication.

Strongly disagree		Disagree		No opinion or uncertain		Agree		Strongly agree
1	2	3	4	5	6	7	8	9

Cargo information has to be sent again more than once a week because information was wrong the first time.

Strongly disagree		Disagree		No opinion or uncertain		Agree		Strongly agree
1	2	3	4	5	6	7	8	9

Cargo information is often double checked because there is a lack of trust in sender accuracy.

Strongly disagree		Disagree		No opinion or uncertain		Agree		Strongly agree
1	2	3	4	5	6	7	8	9

Cargo information is more than once a week double-checked.

Strongly disagree		Disagree		No opinion or uncertain		Agree		Strongly agree
1	2	3	4	5	6	7	8	9

Differences in language skills cause misunderstandings more than once a week.

Strongly disagree		Disagree		No opinion or uncertain		Agree		Strongly agree
1	2	3	4	5	6	7	8	9

Difference in levels of education and experience causes misunderstandings more than once a week.

Strongly disagree		Disagree		No opinion or uncertain		Agree		Strongly agree
1	2	3	4	5	6	7	8	9

There are unsatisfied individuals in the company that does not want to share information.

Strongly disagree		Disagree		No opinion or uncertain		Agree		Strongly agree
1	2	3	4	5	6	7	8	9

Appendix C

INTERVIEWGUIDE FOR SEMI STRUCTURED INTERVIEW WITH ONSHORE MANAGEMENT

What kind of information do you perceive to be important information to send and/or receive when managing the ships operations? Further on, which kind of information is most crucial for the daily management of the ship?

How often does the ship and management communicate, and what kind of information is shared most frequently?

What kind of information do you perceive to have the most influence on a ships sailing schedule?

Is there any particular information that is often repeated, not updated? What do you perceive to be the reason that this information is being repeated more often than other?

In your opinion, what kind of information could be shared…

- More frequent or faster (timeliness)?
- More clearly to reduce ambiguity and improve accuracy?

Regarding the sailing schedule, what kind of information do you perceive to be important to emphasize and to have increased focus on? Further, What can be perceived to cause delays in a ships sailing schedule?

Do you agree with the structure of diagram 1, on page 2? If not, what should be altered? [ed.: figure taken out, since it is the same as figure 1 in the thesis]

AFTER ANALYSIS INTERVIEW WITH ONSHORE OPERATION TEAM.

Go through Power Point slides one by one and let the interviewee comment on them to gain interviewees interpretation of the result. Main questions can come at the end where summary slide is.

This research has focused upon timeliness and accuracy, do you believe there are other elements that are more alerting and need to be looked at, for your case and in general?

Do you expect any different results?

Do you have a different take on timeliness and accuracy of information after conducted the questionnaire?

Perception of a topic or a basic question will always vary from person to person and it is difficult to create a common understanding by using a questionnaire. The analysis of this research shows that it failed in dividing the topic into two topics.

Any concluding remarks? Is there anything of interest within this questionnaire that could/should be further looked at?