



Bachelor thesis

Shipping Management

SCIENCE QUESTION

“What are the carrier advantages and disadvantages of IoT cargo tracking?”

Candidates:

10007

10011

Number of pages: 42

Aalesund 18.12.2020

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Preface

The dissertation is a part of our finishing work on our bachelor degree in shipping management at NTNU in Aalesund.

The research is a result of G2 Ocean and our mutual interest around innovation within the maritime industry. We used knowledge gained from school subjects, to answer the science question. The topic is new to the breakbulk shipping segment, as a result, it has been a challenging process, a factor that has given us further motivation for the subject.

We want to express our gratitude to all the participants from G2 Ocean who contributed to the making of this thesis, and especially Orestis Bakas for his contribution. Also, our supervisor Antoni Vike Danielsen has been helpful, guiding us through.

We acknowledge that our approach can be interpreted as new and experimental. However, we hope and think the work can contribute to further investigation on the subject. We hope that eventually the research can contribute and shed light on a new technology within the breakbulk segment and give benefits to companies that are a part of a supply chain.

Summary

Technology is constantly evolving and takes more significant part in out every day. The technology changes the last years have expanded and is expected to continue. Industries have been pushed towards new thinking, and the shipping market needs to follow this journey.

Tracking of goods is implemented in different industries. If a product is purchased and transported with a postal office, they will deliver updates while the product is transported, about where the package is and when it is supposed to arrive. It is a customer service, that can give the customer control of their purchased item. This type of tracking can also be seen in other logistics processes, including shipping. The normal for several years has been to track the cargo with bar codes and handheld readers, something that demands human recourses. As a result, IoT tracking is proven to be an upcoming alternative. It is a technology that potentially can deliver live updates about cargo location and condition. The forecast shows that IoT market will grow exponentially in the upcoming years and take a more significant part in all businesses. As a result, our research is built around the idea of IoT tracking, were the science question is:

“What are the carrier advantages and disadvantages of IoT cargo tracking?”

The research uses qualitative methodology as a tool to answer the science question. The qualitative method was used through oral interviews. The people that were interviewed had a relevant position for answering the interviewer’s questions. The informants where chose to bring relevant data around the subject, data that will be used to answer the science question.

The research presents different advantages and disadvantages of the potential use of IoT cargo tracking. It is proven that a IoT tracking solution could bring advantages that could be beneficial for a carrier, but negative sides of the technology are also presented. Most advantages are categorized as efficiency, where the disadvantages are touching more human factors such as relation and trust.

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Definitions

IoT: Internet of things, the internet of physical objects.

AIS: Automatic Identification System. Is the most common way of tracking vessels while it is seaborne.

GSM: Global system for mobile communication. It is the mobile connectivity used in mobile phones.

Cloud: A physical network that supports IoT devices and applications. It is the underlaying framework as well as servers and storage. It is the framework that makes it possible to connect devices to the internet.

MyG2: forthcoming Customer portal for G2 Ocean.

G2O: G2 Ocean AS.

COA: Shipping a specific type of cargo over a given period.

Charter party: A contract between a shipowner and a charterer for hiring a vessel.

Booking notes: A contract between a shipper and a customer for carrying goods on a particular vessel to a specified port.

Containerization: Increase in cargo transported by containers.

RoRo vessel: Roll on/Roll off vessel.

Bill of Lading/BOL: Works as the receipt of goods, evidence of contract and a document of title in a shipment.

Tallying: Service of counting cargo in a port.

Breakbulk cargo: Cargo that can be carried by a vessel in its original form either directly on deck or in holds.

Project Cargo: Transportation of large, heavy, high-valuable, or critical commodities.

Open hatch vessel: Bulk carrier where the hatches are extended, to use the full width off the vessel.

ETA: Estimated time of arrival.

SSB: Statistics Norway.

NSD: Norwegian centre of research data.

GDPR: General Data Protection Regulation.

Delimitations

The research is built on the idea that IoT tracking could be used as a tool within the breakbulk shipping segment. There are different ways to perform IoT tracking. The research will present how two tracking solutions can perform but will not examine the theory about the technology.

Advantages and disadvantages presented in this thesis, is a result of interviews and peoples own thoughts. Therefore, it can exist more advantages and disadvantages then the ones presented.

1.0 Introduction

According to our knowledge, none of the breakbulk shipping companies are tracking cargo through the whole supply chain with a live update frequency. This research will investigate carrier advantages and disadvantages with IoT cargo tracking and base it on qualitative interviews.

1.1 Background

Technology is constantly evolving and is taking a vital part for all businesses (Alireza Aliahmadi, 2011). Companies need to keep track of technology changes in order to maintain competitive advantage.

The shipping industry is known to be traditional, and some of the work-related processes and systems implemented years ago, are still used. The last years have brought a change to this. Customers have started to make demands, which forces the shipping companies to new thinking (Media.nesta.org.uk, 2011). As a result, shipping companies are looking for new solutions to make them relevant for a sustainable future (Sys, 2020). G2 Ocean has started a project on mapping IoT tracking technology. Their perception is that tracking technology will be a demand from their customers in the future, and they want to be forefront of the market.

1.2 Science Question

“What are the carrier advantages and disadvantages of IoT cargo tracking?”

1.2.1 Science subjects

The research has been divided into science subjects. These are: interactions and relation, trust, efficiency, advantages, and disadvantages.

1.3 Reader guidance

The theory and method used in the research will be presented first. Next to be presented is the results from the research, followed by a discussion around the topics. The final part will consist of a conclusion as well as a discussion about the way forward.

1.4 How do our study contribute to the debate

Our study is limited to G2 Ocean and their thoughts around IoT tracking. They are a break bulk operator, and although each shipping company operate in different ways, there could be similarities that could be transferable to other shipping companies.

It could also be a beneficial study for other logistic companies who do not operate in the shipping industry, due to their similarity of working with transportation of goods. We hope our study can contribute throwing light to an existing technology, where the prediction shows that the market is expected to grow exponentially in the upcoming years (figure 1). The predicted market growth is due to expectations of new technology development and more users (Tankovska, 2020). The study has potential to show the importance of digitalization and new solutions. Shipping is known to be a traditional industry. We feel that it is one of our duties as upcoming shipping employees, to throw light on the use of technology that can be relevant for the future shipping industry.

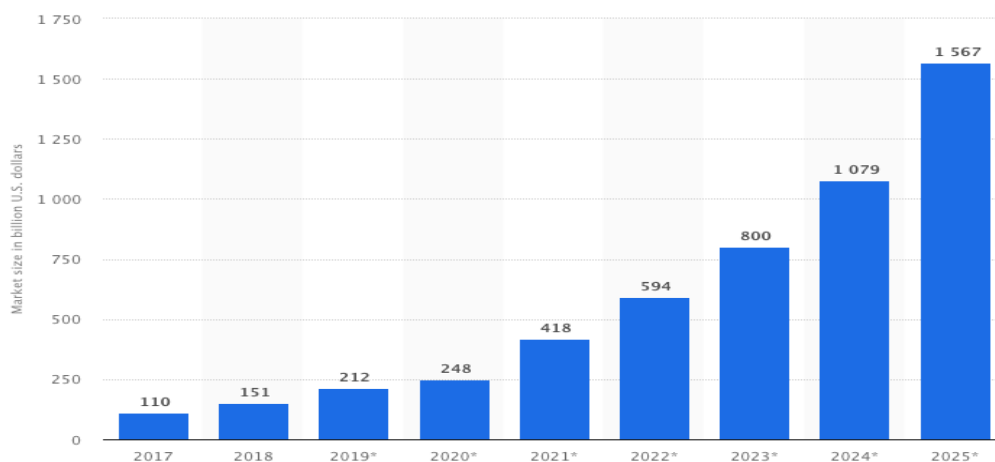


Figure 1 IoT market revenue prediction (Tankovska, 2020)

2.0 Theory

This part consists of theory which will be used in the forthcoming discussion.

2.1 G2 Ocean

G2 Ocean is a joint venture between Grieg Star AS and Gearbulk Norway AS. As a result of the joint venture, they are currently the world's biggest open hatch operator. G2 Ocean operates approximately 130 vessels, where 75% of the fleet is operating in the open hatch market, the remaining vessels are operating in the conventional bulk market (G2Ocean, 2020).

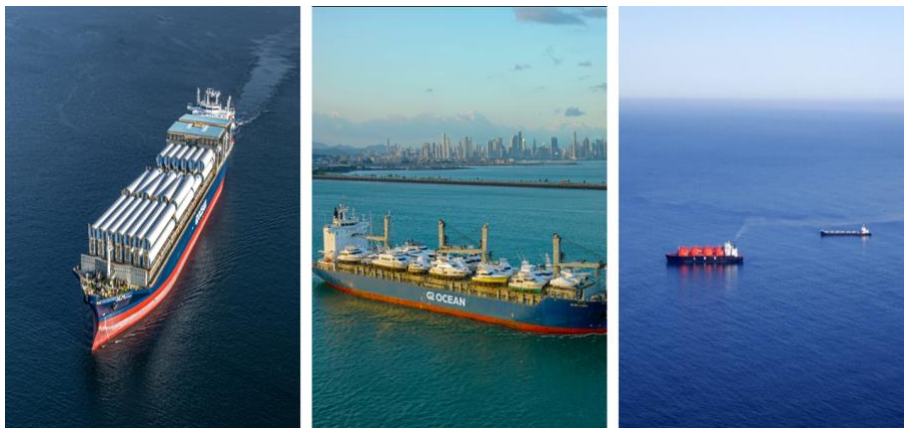


Figure 2 Pictures of some of the vessels G2O operates (G2O internal portal)

G2 Ocean are transporting different cargo types. As a result, they have various customers worldwide. G2 Ocean specializes in breakbulk cargo, and their most transported goods are currently pulp and forestry products. As for today, pulp accounts for 48% of what G2Ocean are transporting (Annual Report, G2Ocean, 2019). One of G2Ocean's expertise is operation of project cargo, where they have a large focus on expanding (G2Ocean, 2020). Project cargo is a category under the breakbulk segment, where large and heavy components are transported. Project cargo are generally loaded on deck, it can also be loaded in holds. Project cargo can be everything from yachts to industrial components like windmill blades and infrastructure.



Figure 3 Example of what cargoes G2O transport (internal portal)

G2 Ocean hold a diverse customer portfolio. They have different types of contracts where some of them are long term COA. They also have customers on one time charter parties or booking notes. (Annual Report, G2Ocean).

Innovation is a part of G2 Ocean strategy, as reflected in their slogan *“pioneering sustainable shipping solutions”*. The focus is to find new and smarter solutions as well as making a technological progress (Annual Report, G2Ocean, 2019, s. 4). The IoT tracking project G2 Ocean currently are running, is one of their innovative initiatives.

2.2 IoT

The research is based on IoT tracking. For this reason, it could be important to get an insight on what IoT is, and the meaning of IoT tracking and tracking sensors.

The internet of things or IoT, refers to physical objects worldwide, connected to the internet. It is built on the idea that physical objects can retrieve and share information through the same *cloud* (Ranger, 2020). The information can be monitored and controlled with a controlling device, which can be anything from a smartphone to a computer. (Trojecki, 2018). Everything from a tv to a car can be connected to a cloud, where you can control and monitor the status from a remote device.

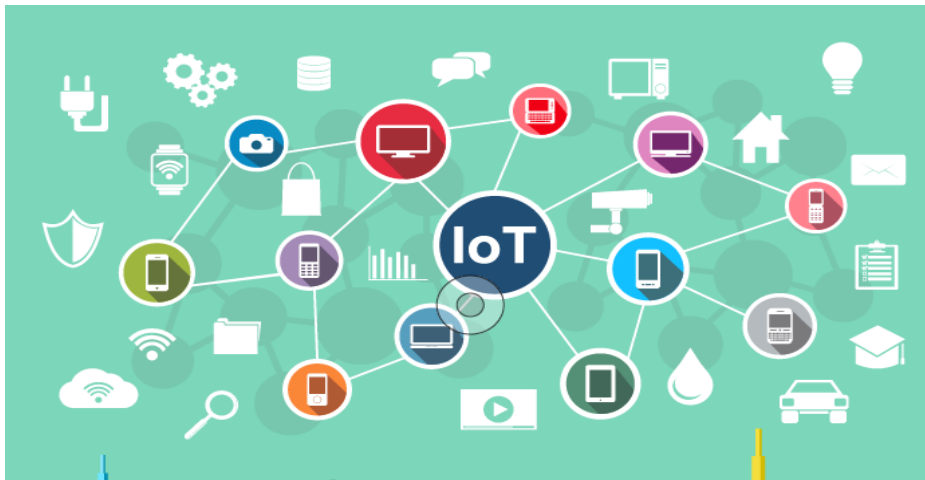


Figure 4 Illustration of a IoT network (Vizah, 2019)

2.2.1 IoT tracking

The functionality of IoT tracking in this case, is to provide overview of goods and give real time visibility of cargo through the supply chain, from shipper to receiver.



Figure 5 Illustration of an tracking sensor (Roambee)

In the first solution, a sensor is attached to the cargo when completed by the manufacturer. The sensor will retrieve information about the object it is attached to. Figure 5 shows a sensor that could be used for tracking. The sensor retrieves information through smaller sensors inside, that are specified for measuring a specific factor. This could be factors like humidity, shock, temperature, and light. The sensor can include a way to monitor location of the goods, this can either be done by GSM or GPS technology.

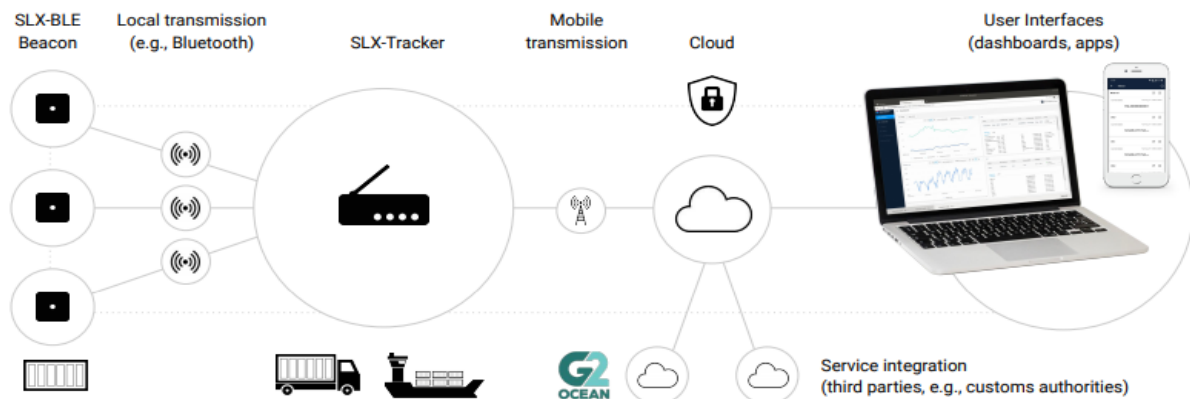


Figure 6 Solution on tracking cargo with beacons and gateway/sensor (G2O internal portal)

Figure 6 present a different solution on tracking cargo. It is built on the same fundamentals as the abovementioned solution, but the sensors are used as a gateway. Beacons are connected to each item as an intermediary, they send the information to a gateway which thereafter forwards the information to a *cloud*.

G2 Ocean have conducted a mapping of tracking technology, where they discovered prices around 50-100 USD for sensors and 10-20 USD for beacons. Further, it will lead to a monthly connectivity fee, and additional cost for implementing the technology into G2 Oceans own system. G2 Ocean are developing a customer portal in form of an application (myg2). The plan is to implement a tracking solution to this application, then G2 Ocean customers can receive updates on their cargo as it is transported. These sensors are based on intricate technology. In general, they are tracking and monitoring the object it is attached to, through the whole supply chain, from manufacturer to receiver.

2.3 Innovation

The research is based on an innovation project. As a result, it will be important to know the meaning of innovation. Easily explained innovation means to *“stay relevant”* (Shapirom, 2016). The common words in all its definitions are, *“changing or improvement of a process or product”* (Tohidi, 2012). Developing new solutions for a company that can be substantiable for the future world. It is not enough to have an idea for a smart solution, you must apply it, if not it is just an idea (Shapirom, 2016). To be innovative could gain competitive advantages for a company. It is important for a company to be innovative to show their customers that they are following the digital transformation. (Fadiyah M.Z, Al Mamun, sofian Yaacob, & Abdul Wahab, 2016).

2.4 Break bulk segment

G2 Ocean operate in the break bulk segment. This is a segment under constant pressure. Break bulk operators are being squeezed, as ro-ro, box ship and dry bulk operators try to capture market share (Wilson, 2018).

The container market is a major competitor. Many segments of the traditional pre-container break bulk market are already containerized. There are different reasons why the cargo has been captured by container vessels. Price, reduction of damage, time savings in ports and the well integration with inland transport, are examples of why cargo has been captured by container vessels. An example of a cargo that has been *“containerized”* is Coffee and Tobacco. *“95% of all European coffee imports are containerized since coffee is a commodity of high value and its consumption rather ubiquitous”* (Notteboom, 2020).

Despite this, the Break bulk segments is not declining nor dying. They have adapted to the market and specialized in product types that are difficult to transport in containers, or where containerization does not represent a valid and cost-efficient proposition (Notteboom, 2020).

2.5 Supply chain management

G2 Ocean are part of a supply chain. Supply chain management or SCM concern the management around flow of goods and services. SCM consists of actors, relationships, and inter-organizational processes. The focal organization is the organization or actor we use as a starting point to understand a supply chain. The supply chain will also consist of participants like customers and their customers. These are often referred to as subcontractors and their subcontractors (see Figure 8). It might be taken for granted that the focal organization can lead and influence the subcontractors (Virum & Persson, 2011, p. 19).

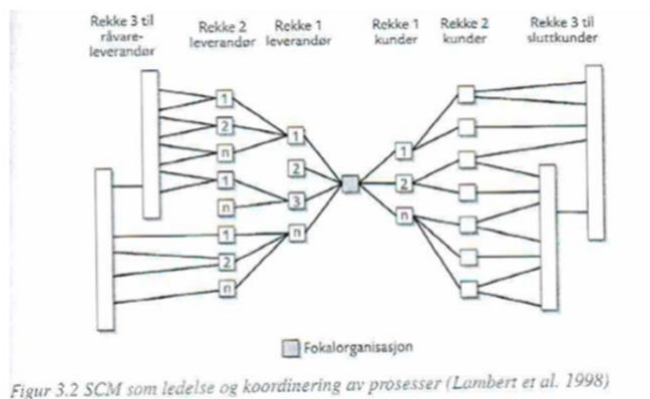


Figure 7 Management and coordination of processes (Virum & Persson, 2011)

It can be economical to adapt activities after each other in a supply chain. Both within a company, but also throughout the network. The links and the order between the activities will be affected by each other. For example, activity B will be affected by how activity A is performed. (Gården).

Interactions and good communication take a part of a well-integrated supply chain. Meaning that the processes that are being performed, are adapted to each other. A scenario could be, if a certain unpredictable event occurs, it can be solved by communicating and working together (Gården, 2014).

2.6 Interactions and relation

The research includes a part about interactions, which can be closely connected to relations.

The definition of the interactions are *“mutual or reciprocal action or influence”*. (merriam webster, 2020) It can be an action between two or more parties, to produce something if a problem needs to be dealt with, or a conversation between two parties. In shipping, carrier and customer relationship consists of interactions. They rely on each other information in order to perform the operations that are required (Maria Boile, 2012). The carrier and customer interact from the first point of contact, when they need to exchange information. Customer to customer interactions or C2C interactions take an important part of all industries and it is proven to be an increasingly important factor for business performance.

An example of interactions is information exchanging. Information exchange concern what the customer wants, and a company can provide. It is important to inform the customer if a deviation from the arrangement occurs. In G2 Oceans´ case this could be if the vessel is getting delayed, then it will be important to notify their customer. Their customers could potentially have made plans based on the ETA they retrieved (Virum & Persson, 2011, pp. 298-299). Researchers have established that information flow is essential to coordinate the activities of companies, or processes in the supply chain. Information flow across the supply chain refers to the level of information sharing and quality of information exchange between members of the supply chain. Information sharing and information quality are recognized as key elements in supply chain management practices (Ramayah, 2010).

Interaction leads to relations. A relation is connections, cooperative working, and organizational- and operational integration, which over time is built up between individuals, departments and companies. Figure 8 shows us the factors included, to establish a customer relation, and what the relationship can lead to. The word used in the figure is “exchange” which shows that any “exchanging” of these factors can lead to certain advantages. One of the results can be learning. When companies operate together and exchange resources, they can also learn from each other, which can lead to increased efficiency (Virum & Persson, 2011, pp. 298-299).

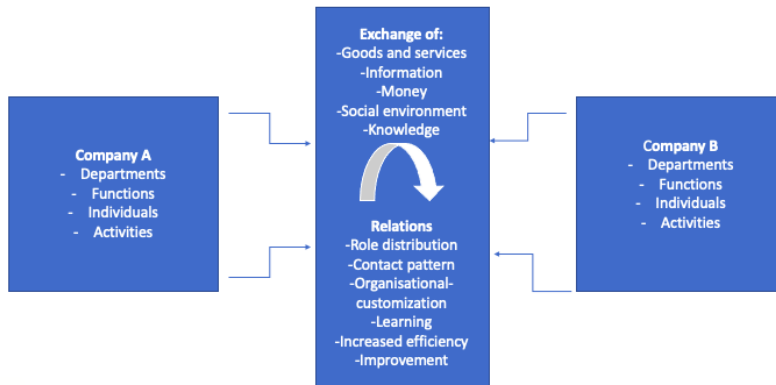


Figure 8 Factors included to establish customer relations (virum & Persson, 2011)

2.7 Trust

Trust is an important factor in customer relations. Scientists give different definitions to the phenomena. Many agree that it concerns the will to accept that one is addicted to each other (Kristian Alm, 2013). Trusting a person/company include that you trust that they will not behave in a way that could harm you. When you hand over something of value, you expose yourself of a risk that the other party might not live up to your expectations (Kristian Alm, 2013). In this case, it could be the shippers that hand over their cargo to G2 Ocean, with an expectation that they will deliver their goods with utmost despatch. Such trust is important between parties (Harrison, 2003).

Trust is based on interactions and relation. It is important wherever risk, uncertainty, or interdependence exists. These are the conditions in many settings, and certainly exist in the relationship between companies and their customers (McKnight, 2000). As conditions become more uncertain because of downsizing, mergers, and more complex business dealings, the need for trust grows (Mishra, 1996). One of the factors to create trust is shown to be communication. Communication is the exchange of information, and is believed to be a strong determinant of trust (Harrison, 2003).

The opposite of trust is control, and the absence of trust demands that the relation needs to be built on control, something that is inefficient in a cooperation. It is preferable with mutual trust in a relation, but a trust relation needs to be built on numerous elements and takes time to establish (Vaagaasar, 2017). Creating trust with limited time, is demanding and increases the need for participants to open up and assumes that all involved participants have good intentions (Edmonson, 2012).

2.8 Efficiency

Efficiency in logistics is an activity to improve the material and information flow in a supply chain (Martin, 2006). The purpose of optimizing efficiency in a logistics function is to reduce costs and increase revenues. Revenues can be increased by improving the delivery service. The delivery service consists of delivery time, delivery reliability, and level of service. Costs can be reduced by improving transport, warehousing and management costs (Virum & Persson, 2011, p. 19). The efficiency can be improved by comparing the delivery service against logistics costs. An example of this could be weighing up the delivery time against transportation costs.

There are three factors that can affect the efficiency in a logistics process. (See figure 9) *Changing the Organizational Structure.* This could be achieved by changing the structure in a company, or by changing the physical flow of goods.

Improving the planning and management processes in a company by implementing new IT solutions or new technology.

Changing the physical flow of goods. This could be accomplished by looking at how the goods are transported and handled. The productivity of ship and shore cranes is one example of something that can affect the physical flow of goods (Virum & Persson, 2011, p. 19).

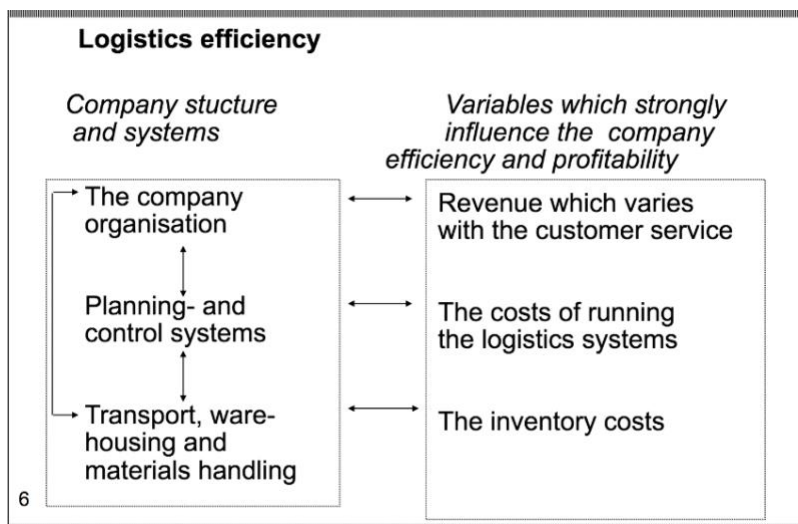


Figure 9 Efficiency of logistic processes (Virum & Persson, 2011)

Several service activities are categorized as logistics. An example is the flow of information between a customer and a supplier. The flow of information can improve the efficiency in a logistic process (Virum & Persson, 2011, pp. 20-22). To improve efficiency in the flow of information, it is important to look at the willingness of the actors to share information. It will also be important to emphasize what information is to be shared. By having a good relationship with the other participant in the supply chain, the chance of being able to improve the efficiency in the information flow increases (Prajogo & Olhager, 2012).

Efficiency can be linked with time management. Time is an immaterial resource, once it is spent it cannot be won back (Kalu, 2012). Companies are looking for reducing time on less important activities, and reallocating this time to more critical activities, like expanding and improving the business. Time management can be defined as the efficient utilization of time to achieve organizational and personal goals (Kalu, 2012). Managing time appropriately leads to achieving results easily with limited resources. Consequently, any productive system, whatever its structure, human, technology or financial support requires efficient and effective time management procedure (Adu-Oppong, 2014).

2.9 Cyber security

Implementing new technology solutions creates possibilities for breaches in the cyber security. Hacking is a term that deals with the misuse of a computer to break the security of another computing system. Hacking is used to steal data, corrupt systems or files or to disrupt data-related activities in any way (techopedia, 2020).

Breaches in cyber security increase in line with the digitalization of companies. New IT solutions and innovative data programs has increased the interest for hackers to obtain this information. Even though the companies are spending more time and money to preventing potential data breaches, hackers have become more sophisticated and cyber security breaches have become more frequent (Koyame-Marsh, 2014).

The number of cyber-attacks against the shipping industry have increased in recent years. In the last three years, four of the largest shipping companies have been attacked by hackers (Cimpanu, 2020). The hackers attack shore-based systems which consist of business offices and data centres. The reason they attack shore-based systems is to get access to sensitive information (Baraniuk, 2018). This information concerns personal information, email exchange within the supply chain and sensitive information about the cargo and the location of the vessels (bestpractic, 2020).

3.0 Method

A method can be explained as a tool or a gear. It is a tool to answer questions and collecting new knowledge (Larsen, 2017, p. 17).

A methodological survey covers how to collect, organize, and interpret information about a subject. There are two different types of methodological surveys, quantitative and qualitative method. Several factors provide guidelines for which method is best suited for the research. The degree of openness can provide guidelines for which methods are best suited. If the approach to the thesis is open, a qualitative method is best suited. In a closer approach, quantitative methods will be best suited (Larsen, 2017, p. 17).

The science question provides guidelines for which method the researcher should choose. If he/she is looking for opinions around a theme, it is often preferable to use a qualitative method. On the other hand, if the researcher is interested in linking the science question to quantifiable standardized answers, a quantitative method can be beneficial (Larsen, 2017, pp. 25-27).

The researcher will need to think of what he/she wants to accomplish with the survey. If the researcher wants a statistically representative survey, a quantitative method would be preferable. A statistically representative survey means that it applies to the entire population. On the other hand, if the researcher needs in-depth information in a specific area, a qualitative method will be best suited (Larsen, 2017, pp. 25-27) .

It is important to take the informants into account. Can they speak? Can they write? This is essential to consider before you choose your method. The relationship with the informants can also have an impact on the method used in this research. Close relationships increase the possibility to arrange meetings for qualitative interviews (Larsen, 2017, pp. 25-27).

3.1 Inductive and deductive approach

In academia it is often referred to an inductive or a deductive approach. These approaches contribute on explaining the method used for the survey (Larsen, 2017, p. 24)

In a deductive approach, the researcher takes concept and theory, and links the thesis question to this. The researcher bases the research on general concepts and theories, and then uses these to explain what is being studied (Tellmann, 2018). The thesis question in such studies is often formulated by hypotheses or questions (Larsen, 2017, p. 24).

In an inductive approach, the researcher has not based his research on any particular theory but has an open approach. The thesis question is often formulated during the research process. The researcher is open to various explanations and does not rule out anything before the study starts (Tellmann, 2018). It will often be connected relevant theory to the data collected (Larsen, 2017, p. 24).

3.2 Validity and reliability

Validity and reliability are important to consider while working with the methodology. These terms help to evaluate and to be critical of own methods in a project (Johannessen, Tufte, & Christoffersen, 2010). It is important to understand that validity and reliability have different focuses, depending on the use of method. This project uses a qualitative method, therefore validity and reliability are described from a qualitative methods perspective.

3.2.1 Validity

Validity within a qualitative method focus on verifiability, credibility and transfer value (Larsen, 2017, pp. 93-94). *Verifiability* concerns the extent to examine what the researcher are going to examine. Examination investigates if it is collected relevant data for the science question, this will make the conclusion more valid. *Credibility* aims to make the interpretation valid for the reality studied. The researcher needs informants with credibility around the topic. It is important to examine if the conclusions match conclusions for similar studies. *Transfer value* in a qualitative method will help to transfer findings to other groups than just those who participated in the survey (Larsen, 2017, pp. 93-94).

It can be difficult to consider validity. By conducting a qualitative interview, the interviewer gets the opportunity to ask follow-up questions, this can make it easier to get relevant information.

3.2.2 Reliability

Reliability refers to accuracy or trustworthiness. Accordingly, the survey is based on trustworthiness and accuracy throughout the whole process. Reliability in a qualitative method is not as critical as in a quantitative method. The reason for this is that in a qualitative method, the researcher uses himself as an instrument to interpret the data he/she obtains (Johannessen, Tufte, & Christoffersen, 2010).

It is easier to provide high reliability in a quantitative method than in a qualitative method. In a quantitative method it is possible to get several scientists to perform the same survey, and if the conclusions are relatively similar the reliability is high. In a qualitative method, researchers can interpret information and perceive situations differently. This means that the conclusions can end up different from each other.

The informants may also be affected by the interview situation, which can cause them to answer differently from what they are thinking. This weakens the reliability (Larsen, 2017, pp. 94-95)

Reliability in a qualitative method is often linked to credibility. Credibility is important for both validity and reliability. By having a systematic data collection and process, the chance for reliability increase.

3.2.3 Transparency

Transparency is one of the most important factors to consider in a science project (Tjora, 2017). This shows how validity can strengthen a qualitative method. This is done by showing how own analyses provide a basis for the conclusions, by justifying why the conclusion has become as it is and by referring to the interpretations that have been made. The goal of having a high level of transparency in the science project, is to give the reader enough insight in the research, so that he/she can decide the quality of it. A way to ensure good transparency is to refer to quotations and observation notes taken from the informants (Tjora, 2017).

3.3 Quantitative methodology

There are different types of quantitative methods. It is common to categorize a quantitative method as a survey. A quantitative method consists of “hard data”. This means countable data. After a quantitative method has been performed, it should be possible to count the result (Larsen, 2017, p. 25).

3.4 Qualitative methodology

Qualitative methodology can be considered if the researcher are interested in developing knowledge about qualities, attributes and characteristics of various phenomena (Malterud, 2011, p. 82). The methodology concern data which cannot be quantifiable. This is referred to as “*soft data*” (Larsen, 2017, p. 25). Qualitative methodology is used when the thesis question is open. A qualitative methodology can be a great tool if the researcher wants to gain in-depth knowledge and holistic understanding of a specific context, or to develop concepts, categories, and typologies.

In a qualitative methodology, an interview is the most common way to collect data. The interview form may vary but will mainly be divided into five categorizes. One of the interview forms are *Interview with a prepared interview form*. This is a structured interview which gives the informant the opportunity to respond openly. An *unstructured interview* is based on preparing an interview guide through key words, so the informant can speak freely about the topic. *Semi-structured interview* is based on a prepared interview guide but is not strict to follow it. The interviewer asks follow-up questions where he/she wants more information. *Conversation interview* is a longer and more intense interview where the interviewer seeks a deeper understanding of a person's behaviour, actions, motives, and experiences. If the interviewer seeks information from different people, and the information does not concern topics which is difficult to answer, the interviewer can use a *group interview* to reduce time. The interviewer gather a group of people to have a conversation about a specific theme (Larsen, 2017, pp. 99-101).

Furthermore, observation is also an alternative to gather data. Observation is all about gathering information based on what the interviewer sees and experience.

3.4.1 Selections of informants

To gather relevant information about the topic, it is important to choose informants accurately. When a qualitative method is used, statistical generalization is not a goal, so it is possible to choose the informants freely. The most common way to choose informants in a qualitative method is through non-probability selection (Larsen, 2017, pp. 89-91). Non-probability selection may vary, it will mainly be divided into five different categories.

Discretionary selection. The researcher selects the informant he/she prefer to participate in the project. It is common to select people with a different background to get an omnifarious selection. An example of different criteria are gender, age and education.

A different way to select informants is through *self-selection*. Informants can decide if they want to participate in the project. The researcher sends out information about the project, followed by an invitation to participate.

In a *random selection*, the selection is not selected by neither the researchers nor the informants. An example of the method is when a scientist asks different people on the street questions.

The snowball method is another way to selected informants. Researcher contacts people who contain knowledge about the topic, then they can recommend other participants as well.

In *selection by quotas* the researcher selects informants by using non-probability selection. The researcher starts by providing guidelines for who he/she want to interview. An example of guidelines can be “*ten girls and ten boys, or ten informants over the age of 40, and ten persons under the age of 40*”. After the researcher has accomplished these guidelines, he/she can choose by using a random selection.

It is important to remember that the informants who are selected to participate, will primarily represent themselves, but can also represent a common view or an organization's point of view (Tjora, 2017). They will therefore not necessarily represent a global point of view (Larsen, 2017, pp. 89-91).

3.5 Methodological approach

Writing the bachelor thesis, while being interns at G2 Ocean, opened an opportunity to get in touch with potential informants.

The thesis is not based on a specific theory. We were interested in the opinions of various people within G2 Ocean. This meant that the approach remained open. No special thoughts or explanations were emphasized more than others throughout the process. An inductive approach became natural for this thesis. The thesis question was created through the process, and relevant theory was linked to the information we obtained from interviews.

The purpose was not to find a result that was statistically representative of the entire shipping industry. The approach emphasized the advantages and disadvantages of IoT tracking for G2Ocean, which means that a qualitative method provided more depth within this specific shipping company. Own preferences became a factor when selecting method. We wanted to talk to different departments in the company, to get in touch with new people, and to get an overall picture of how complex a company is.

This built the foundation for choosing a qualitative method, in the form of an interview, as the methodological approach for the research.

3.5.1 Interview guide

When talking about interview forms, it is often distinguished between structured and unstructured interview forms. In this assignment, it was chosen to use a semi-structured interview form. This was done by creating an interview guide with pre-formulated questions that would help address the topics that were relevant to the survey (Tjora, 2017).

The interview guide was flexible and was mainly used to help the interviewers if they faced obstacles during the interview. Using a semi-structured interview guide, gave the opportunity to be flexible regarding the order of the questions. It gave the opportunity to ask follow-up questions the interviewer wanted the informant to be more specific. The informant was also given the opportunity to address topics they felt were relevant for the interview.

The interviewer was interested in the informants opinions about IoT cargo tracking, as a result it was important to not give any guidelines throughout the interview process (Dalen, 2004, pp. 30-31). Therefore, the questions did not require any special knowledge from the informant in advance. It was assumed that the informant knew what the topic concerned, but it did not require any technical knowledge to be able to answer the questions. It was avoided to ask sensitive questions, as this may prevent the informant from commenting on the topic. Since the researcher were going to interview people with different backgrounds and jobs, the interview guide had to be general. This was created to give everyone equal opportunities to answer the questions.

The interview guide was structured with an introduction, a main section, and a conclusion. The introduction was the start of the interview and did not require much reflection. This part was to get the interviewer and the informant to start talking. The main section was the core of the interview. Here the interviewer asked questions which the informant had to reflect around. In this part, the questions were aimed towards the thesis question. The interview was finalized with a conclusion. It was asked if the informant had any final thought around the subject.

Prior to the interviews, several test interviews were conducted. This was used as a tool to check the functionality of the interview guide, it was also for the interviewers to prepare mentally and professionally before the interviews (Dalland, 2012, p. 167).

3.5.2 Selection of informants

By using a qualitative method, where statistical generalization is not a goal, the choice fell on using "non-probability selection", to choose informant. In the case of "non-probability selection", the participants are not randomly selected, nor do they have the same opportunity to be selected to participate. By not making a random sample, it must be made precise that the information that emerges in this thesis will not be statistically representative of the entire population (Larsen, 2017, p. 89).

As mentioned, there are several forms for "non-probability selection". Discretionary selection is chosen for this thesis. Discretionary selection is a form of strategic selection. This means that the researcher consciously chooses who is to participate in the study (Larsen, 2017, p. 89). This gave the researchers freedom to interview the persons they thought were best to shed light on our thesis question. The informants were chosen according to certain criteria. These criteria were education and position within G2 Ocean. The researchers wanted to investigate what the different departments within G2 Ocean thought about IoT tracking, and therefore chose to interview different people who worked in these departments.

3.5.3 Permission to store personal data

On 20 July 2018, the EU's new law on General Data Protection Regulation (GDPR) entered into force in Norway (Regjeringen.no, 2016). This was something we had to consider in our Bachelor thesis. Audio recordings of conversations collect a lot of information about a person, Information like a person's voice and mood. Audio recordings of conversations are therefore to be regarded as an intrusive form of processing of personal data.

To stay within the regulations, it was consulted with the Norwegian Center for Research Data. On the 22. of October 2020, our request was approved by NSD, (Attachments 3). We were recommended to make an information letter that referred to information about the subject and the interviewee's rights, (attachment 2). This was done by using NSD's information template.

3.5.4 Conducting the interview

We wanted to know what people within G2 Ocean think around the subject. The goal was to get a representative pick of relevant persons from G2 Ocean to say what they were thinking around the use of sensors. Employees from the chartering department, operations department as well as claims and innovation department were interviewed. As a result of interviewing people from different departments, we hoped to get different perspectives around the same subject. Their educational background was also varying, something that could strengthen the different perspectives.

Educational background:	Quantity:
Degree in logistic and supply chain management	2
Degree in economics	1
Degree In law	1
Sailing background	1
Degree in business development	1

The interview was held over Microsoft teams, which is a video conference service. Since the interviews were held over video call and connection can vary, it is important to focus on being precise. Sometimes the interviewers repeated the informants answer, to make sure that the answer was understood correctly (Tjora, 2017)

One interviewer was asking the question, as the second interviewer had focus towards reading body language and add follow-up questions if the main interviewer forgot to. Follow-up questions were also predefined in case the informant struggled to answer.

Six interviews were conducted with an average length of thirty minutes. This led to much relevant data around the subject. Looking back, six interviews with a length of thirty minutes led to a lot of work with transcription and coding, which is the downside of conducting several interviews.

4.0 Results from the interviews

The data gathered in the research are from the employees own experience and knowledge, and therefore has a risk for wrong information. The informants have own interest for the company and could potentially give subjective information.

This part of the thesis will focus on presenting the data gathered from the interviews. It is divided into key topics and presents data under the different topics. The different interviews will be compared, and it will be gathered relevant information for the topic.

4.1 Interactions

Interactions with customers are a big part of G2 Ocean daily work. The Demand from the customer is what controls G2 Ocean's business performance. If there is no demand from G2 Ocean's customer, there is no work, which results in low revenues. One of the questions asked was concerning interactions with customers and how they could be affected by an IoT tracking solution. What most of the informant started to talk about, was the unnecessary interactions, meaning emails and phone calls about cargo and vessels location.

Informant 2 said *“so the IoT, will save miscommunication back and forth, «where is my cargo» «oh your cargo is there» «give me an ETA», «when will my vessel arrive?» and all these extra emails in your inbox will be saved, by a log on, put in the vessel, tracking number, okay, I see. And then the only further email will be «I see that the vessel is delayed, why?» unless this is also informed by technology. Then the charterer or operator can focus on something else, and more important”*.

Informant 6 shared the same thought around less of the unnecessary emails that occupies time. *“There is a lot of communication points, whether it is emails or phone calls, where the topic is “where the vessels is” or “where the cargo is”. And even though it is probably good to have contact with your customer, you would probably rather spend your time talking about more important things than that”*.

It was asked if they thought this technology would lead to more or fewer interactions. All the informants had the same perception of that. They were absolutely clear on the answer that it will be less interactions with the customers, if G2 Ocean would implement IoT sensors and tracking technology. Apart from the shared thought on less interactions, informant 4 also said that it potentially could bring up some new unnecessary subjects from the costumers if all of the information where to be shared at the same time. *“I think it is important to choose wisely what to share and when to share it. If we share to much without an explanation, it has potential to create a lot of unnecessary questions”*.

They shed light on another important aspect when it comes to interactions. Even though they were agreeing that it will mean less interactions with customers, they had some mixed thoughts when it came to if that will have a positive or negative effect for their costumer relations.

Informant 1 said that *“The downside could be that it is a good reason to keep the personal contact. The danger if it this leads to minimal contact because they can gather all the information, they need without talking to us”*. This is an important subject since all the income G2 Ocean have is from their customers and it is beneficial to keep a good personal relationship between the parties.

4.2 Trust

Trust between companies is an important factor when companies are working together. As informant 6 is saying in the interview *“trust is the reason why our customers continue to work with us, and the reason we get new costumers is because we are a trustful company”*. G2 Ocean have a big focus on being a trustful company, and therefore trust is something they try to establish with their customers.

The fact that G2 Ocean have established themselves as a trustful company is mentioned by the other informants as well. Informant 3 is sharing the same perception *“there is a trust between shippers and G2, that is why they choose to come back to G2 for renewing their contract. So, the trust is already there”*.

“What are the carrier advantages and disadvantages of IoT cargo tracking?”

The question that highlighted the subject was *“how can the IoT tracking affect the trust between carrier and customer?”* The question is making the informants reflect around a specific factor and opens for a variety of answers.

Informant 6 was answering *“shippers would have more trust on us, and we would have more trust also, because sometimes the ships are in port and we don't have any cargo, and the shippers are saying “okey the cargo is coming” when it is actually not. In Spain we pay a high fee in the port per day. So, it is vice versa, the shipowners will have more trust to the shippers and the shippers would have more trust to the shipowners. Both will do best if the cargo is tracked and transport the goods at the best possible way.”* What the informant is saying here is that it could increase trust in both ends, because both parties have information that need to be shared in different parts of the supply chain.

Informant 4 supports this statement *“if we are open and honest about how these systems work, it can be a tool to establish trust”*. They said that it could be a tool for trust, but as mentioned earlier, this is a factor that is underlaying in the relationship between G2 Ocean and their customers. Informant 1 does also support this *“the fact that we would open up, would show our customers that we have nothing to hide”*.

4.3 Efficiency

The informants were asked questions about what the company does today, to be as efficient as possible. This could locate if there potentially would be a need for implementing an IoT tracking system. Questions were asked about how IoT tracking could make various processes more efficient. Both administrative processes, but also operational processes.

One of the questions highlighted G2 Ocean efficiency focus today, *“How are G2 Ocean trying to be as efficient as possible today?”*. Informant 5 responded to this. He/she said *“We are trying to be as efficient as possible in everything we do”*. He/she 5 also highlighted why it is so important for G2 Ocean to be as efficient as possible in all processes involving transportation of goods. He/she said, *«You see that a lot of our customers are expanding their businesses, this gives them more power in the market»*. Meaning that the customers can put great pressure on the carrier to be both cost-effective, while at the same time the operational efficiency remains the same. Efficiency is strongly linked to pressure from customers, and pressure from the competitive market.

Another question focused on how a tracking solution would affect the efficiency in the company. All the informants agreed that IoT tracking could increase the efficiency in various processes. The way an IoT tracking solution could affect the efficiency, is categorized into three different sections. Efficiency in the *administrative work*. This will concern how the efficiency can be affected in the office-work. *Operational* efficiency concern how different processes on the vessels or in the berths can be affected. Cost efficiency will look into if costs can be reduced if implementing of IoT cargo tracking can affect the efficiency in different processes.

Efficiency in the administrative work

All the informants mentioned that from an administrative point of view, IoT tracking would help to make processes more efficient. Informant 1 said, *“Where we previously had to enter information manually into the systems, with IoT technology this can be read directly from our own mobile phone”*. Informant 4 shared the same thoughts and said that *“I may not do the manual input myself, but there will always be someone else in the network who has to do it. By removing this process and by implementing IoT technology, all the work of gathering information and documenting information will be gone.”*

Informants 6 introduced a situation where the technology would come to its full use, *“I just want to say that the big advantages with IoT technology, is when it comes to multiple cargos, meaning more than one customer on the same vessel. Especially if we take an industry where they carry maybe thousands of consignments and sending this information will be a lot of unnecessary work, having the IoT technology can actually help us shape this process up and let the information go directly from the cargo, by the sensors and then straight to the customers”*. So, in the case where G2 Ocean would have a lot of different customers loading cargo on their vessel, tracking with IoT would spare a lot of manual work of sending information to all the involved shippers.

Informant 4, 2 and 6 agreed that using IoT sensor technology, can impact how the claims department do their daily work. Informant 4 stated that *“A device that registers movements, shocks, temperature and humidity can contribute to an investigation, if it is suspected that a damage on the cargo has occurred”*. Informant 6 shares this view by saying that *“The more information we have about the condition of the cargo, and what has happened to it, the better we can handle a possible case that may occur”*.

Efficiency in the operational work

Several of the informants highlighted the job of a "tally" as an operational process that had potential to improve the operational efficiency. Informant 1 said that *"Here a lot can probably be done to make the process more efficient. IoT tracking technology will provide much more reliable information and data"*. Informant 5 shared the same point of view. He/she said that *"there are people in the port who are actually telling the quantity of the cargo. This is a process which IoT technology can remove"*. Informant 4 stated that *"Regardless of whether we work 2, 5 or 7 days, they stand there and count. If we work 24 hours a day, they work 24 hours a day"*.

Efficiency in terms of costs

The informants agreed that IoT tracking could potentially affect the cost efficiently in a positive way. Most of the informants said that *"If IoT tracking makes the administrative process and the operational process more efficient, then the cost savings will come over time"*. Informant 6 threw light on an interesting topic. He/she said that *"What I have read from a survey from the US is that there are approximately a 30 billion loss in international transportation, because of lost and theft on the cargo. So, if this happens on an annual basis, it would be room for improvement. I think IoT tracking could be a part of that improvement."*

4.4 Advantages and disadvantages

The results above have concerned advantages and disadvantages within special areas. As mentioned, we wanted to take some of the most important subjects, step by step so we could make them start thinking and therefore it has been a lot of advantages and disadvantages mentioned already. At the end of the interview, we asked the informants *"what is the advantages and disadvantages with implementing IoT sensors and cargo tracking?"*. The reason for this was to get a summary of what they already had said and to get them to think outside the subjects we had presented them. This part will focus on the new subjects that came out of these two questions.

4.4.1 Advantages

Customer Advantages

Two of the interviews mentioned customer advantage, where they see that IoT could bring a certain customer advantage, when it comes to getting new customers and keeping the current ones. Informant 1 said *“If we get our customer on to this and it is something that works for them, I really believe that the barrier to change over to others, unless you are twice as expensive, is higher”*. If the technology is something that works for the customer and they start a large-scale process implementing it together with G2 Ocean, this can lead to the customer staying with them. As informant 4 said, if you implement something and it works *“the barrier to change over to others is higher”*. This is based on the technology working for the customers and them finding a value in it from their perspective.

Innovative Company

Informant 2 had another perspective that relates to marketing, which is showing that G2 Ocean is a digitalised company *“it can show that we are a digitalised company, where we are investing in progressing”*. This can be something that can be shown to the customer and market that they are in the forefront in developing new solutions for the future. Marketing with this type of content can lead to interests by companies that want to be seen as innovative.

4.4.2 Disadvantages

Cost

One of the disadvantages that was mentioned in most of the interviews, was the concerning the extra cost of IoT tracking. Informant 1 said that *“If it costs money, we often see that it can be a challenge to get customers on board with the project”*. Informant 6 shared the same view. He/she said that *“I am worried about the cost for the installation and the cost for the service.”* He/she also said that *“I think if it is based on a GPS it can be quite costly. But I also know that there are some devices that are running on battery, which then would not be that costly”*.

Informant 3 shed light on the topic of cost per unit. He/she said that *“We must invest eventually. When a lot of people are using it and there is a demand for the units in the market, the price will eventually go down.”* By this statement he/she thought that the price will go down if IoT tracking becomes a requirement from customers and the market in general.

Cyber security

Informant 3 and informant 5 had common thoughts about a potential disadvantage of IoT tracking. Informant 3 said that *“One of the disadvantages I can think of, is regarding to cyber security. If the information is badly protected and the cargo is stolen, it can cause serious problems for the business.”* The informant stated that it is important to protect the information to avoid it being stolen.

5.0 Discussion

This part includes a discussion around the results from the interviews and will be rooted with presented theory.

5.1 Interactions

As we see from the findings, there is a shared thought that IoT sensors can lead to fewer unnecessary interactions and communication points with the customers, either it is phone calls or emails. Time is a limited resource (Kalu, 2012). If this time gets spared, they could allocate more resources in form of manpower for other activities that are more important for the company. Like making new customers and new trades, being activities that are important actions for a company growth. If IoT sensors can be defined as a time reducer for less important activities, it could also be seen as a tool for time management. Informant 1 is addressing this when he/she got the question about interactions. *“it is not necessarily to cut resources but use them better”*.

Fewer interactions can be interpreted as a beneficial outcome. However, relation is an important factor when you are doing business where you are relying on customer demand (Virum & Persson, 2011). It is an advantage to have a good relationship with the customers, so you get to be their preferred partner (Virum & Persson, 2011). If IoT tracking can lead to less customer interactions, it could potentially lead to a weaker customer relationship. As a result, it would be important to look at other ways to keep the communication and exchange of information, to maintain the good relationship with their customers.

If all cargo information is shared at the same time, it could lead to additional questions, which could be avoided if the information were withheld. G2 Ocean would need to look at how the information is shared and when it is shared. Some of their customers may rely on this information to start their internal processes. Potentially they could already have sold the cargo. Even if it is important to consider when and what information to share, it is important to think about the customers need of precise information exchange (Virum & Persson, 2011). When implementing the tracking system, information flow and exchange should be a topic for discussion, as it has proven that sharing of information is a key element in supply chain management (Ramayah, 2010). The tracking solution has potential in being a tool for exchange

of information, something that could make G2 Oceans job easier, but as informant 4 said *“it is important to choose wisely what to share and when to share it”*

5.2 Trust

The informants stated that the tracking technology, could lead to limited room for withholding information. If an operator delivers a location of the ship that is wrong, the shipper can check that information and the same will apply the other way around. This is a general thought the informants had, where they feel that it could lead to more honest relationships, were there would be minimal room for miss information, because all the information is available for everyone.

Trust is a tool to avoid the need of control (Vaagaasar, 2017, pp. 200-202). The tracking technology could be a tool for information control, since it delivers real time updates on the cargo and its location, which can be shared to all participants of the supply chain. If the involved parties have a fundamental of trust to each other there would not be need for a technology to confirm that the information they deliver is valid (Vaagaasar, 2017, pp. 202-204). If G2 Ocean customers trust that G2 Ocean will fulfil all duties, and avoid doing actions that could harm them, a surveillance tool would not be needed (Kristian Alm, 2013).

The informants general perception is that trust is a fundamental factor which already exists between G2 Ocean and their customers. G2 Ocean have some long-term customers, which they have been doing business with for a long time. In the long-term relations, G2 Ocean claims that trust is why they prefer them as their carrier. When they have a strong trust relation to each other, a tracking solution that can bring an information control might not be necessary.

G2 Ocean also have customers where the cooperation period has been for a shorter period, and some customers are just for one voyage. Trust building in a relation, requires time (Edmonson, 2012), as a result *“control”* or in this case *“tracking”*, might be the right solution for that customer group (Vaagaasar, 2017, pp. 202-204). It can provide trustworthy information without the need of an underlying trust relation. Communication is important for trust (Harrison, 2003), if tracking of cargo means less interactions as proven under the last topic, this might potentially weaken the trust relation. As a result, it could be important to maintain the communication by other methods.

5.3 Efficiency

Break-bulk shipping is a relatively small segment in the shipping industry, and a segment characterized by competition. There is competition from Ro-Ro vessels, dry bulk vessels, and from the container vessels. Efficiency is therefore important, and they need to save costs, where costs can be saved. But also, to reduce time spent on administrative and operational tasks. This, together with specialization on cargo that container vessels are unable to transport, are the major driving force for the break bulk segment for being a competitor in the shipping industry.

Administrative efficiency

The informants agreed that IoT tracking could improve the efficiency for administrative tasks. Today, a lot of time is spent gathering information and distribute this information to the person who needs it. With IoT tracking, this information would be transported to the end user, without others having to spend their time manually collecting and transporting this information. By changing the physical flow of information, they can improve the efficiency in a logistics process (Virum & Persson, 2011, pp. 20-22). This can be achieved by improving the information flow in the supply chain. If IoT tracking helps to improve the information flow in a supply chain, then it is possible to affect the efficiency in the logistic process.

G2 Ocean also conduct voyages where they are transporting cargo for more than one customer on the same vessel. On these types of voyages, it can demand a lot of recourses if the operator needs to contact each customer with information on the cargo. As informant 6 said, *“this would be an example of where IoT tracking will come to its full use, by desaturating the information to all customers of interest”*. It would require that all the customers would agree to a tracking solution, which could be a challenge, and might not be the first step if this where to be implemented. In the longer term this might be an advantage that can increase the administrative efficiency.

Several of the informants agreed that IoT tracking could contribute to make the claims department more efficient. During a claims process, a lot of time and resources are allocated to investigate where the potential damage occurred. The sensors can give information about shock/tilt, where the shock happened and when, this also works if unusual conditions on temperature or humidity occurs. As a result, it might be easier to retrieve information about where and what happened to the cargo, then the process of obtaining the necessary information to build a defence, can be reduced. When the parties discuss who is the responsible party for the damage, the sensors could contribute to indicate the reason why the damage has occurred. This can decrease the time used for negotiations. Informant 2 explained this by stating that *“if we know where the possible case happened, and if we can prove it, the customer will have difficulty on providing a defence for a possible claim case”*. Time used for retrieving information, and negotiation with customer could be reduced, as a result it could increase the efficiency within the claims department.

Operational efficiency

It can be questioned whether using a *“tally company”* is the most time and cost-efficient way to get an overview over the amount of cargo loaded or discharged in the port. Implementing a IoT tracking device on the cargo, could remove the job of a *“tally”*. This can improve the operational efficiency in the port, as well as improving the cost efficiency on a voyage. It can also help to provide correct and faster information. By implementing a tracking device on the cargo, could remove the potential for human error.

A human error can be defined as the failure of a planned action to achieve a desired outcome (nopsema, 2020). People can be trained to perform a job, but it will differ from how an IT solution would have performed the same job. Humans have a mental aspect that software and hardware do not contain. These mental aspects can be emotions, pressure handling and the ability to multitask. By implementing IoT cargo tracking, they will remove the human aspect from the activity. Meaning that they are not dependent on how a person behaves on a specific day the cargo is to be counted in the port (Houtermans, 2014).

Cost efficiency

IoT tracking falls under point 2 in the model to improve efficiency in a logistics process (figure 9). By implementing new technology, the company can be able to improve the efficiency. The costs can be improved by looking at specific activities that deal with transporting goods. To increase cost efficiency, the company must understand how IoT tracking can affect each activity. These are activities such as transport costs, warehouse costs and management costs. Most of the informants stated that if IoT tracking can make the administrative and operational processes more efficient, then cost savings will come as a result of this.

5.4 Advantages

Customer Advantages

The informants mentioned that it is possible to gain customer advantages by working together with their customers on a project and implementing the system together. They could create a closer relation by working together on something that hopefully could gain both parties. If it were to be implemented successfully and the technology would work as planned, it would potentially help strengthen the barrier of changing carrier, since changing of systems and relations would demand time. If they implement it together it also opens a potential of strengthening the relationship with customers. Exchange of information and cooperative working have been shown to be a factor to create a relation (Virum & Persson, 2011, ss. 298-299), something this potentially could do.

Digitalized Company

As mentioned in the result, to bring new digital solutions can show the customers that G2 Ocean is a company that tries to follow the technological evolution. Other companies could be sceptical to invest in new solutions due to the cost, and by showing that G2 Ocean would invest in a new technology this will show that G2 Ocean are in the forefront. One of the informants said, *“I wanted to work in G2Ocean was because I had a perception that it was a high focus on innovation”*. This can give an indication that G2Ocean have a good marketing strategy towards establishing themselves as an innovative company. If the employees want to work there because of their innovative focus, this can be transferable to customers. Shippers may want to work with G2 Ocean because they are in the forefront of the market. It is important to be an innovative company to gain competitive advantage (Fadiyah M.Z, Al Mamun, sofian

Yaacob, & Abdul Wahab, 2016). If G2 Ocean market themselves as a company with focus on digitization and innovation it can bring advantages in the end.

5.5 Disadvantages

Cost

Several of the informants were concerned about the price of implementing IoT sensors. The price will be based on how advanced the IoT sensor is. If the technology is tracking location, shocks, humidity, and temperature, and if it does this via a GPS transmitter, the devices can be costly. The company must investigate what benefits IoT tracking has. Weigh the advantages against the disadvantages and see if it is worth implementing this at an early stage. It can be possible to wait until the demand is higher and there are more suppliers in the market. It is worth mentioning that by implementing this at an early stage, the company can be a pioneer in the market.

Cyber security

If sensitive information had been stolen, it might have devastating consequences for the company and the participants in the supply chain. By implementing IoT tracking, it would open a new opportunity for hackers to obtain sensitive information. This information could have been used to find the location of a vessel, and then seize an attack on the vessels which can carry cargo of value. It could also be used to freeze the information flow in the supply chain, which could lead to ransom demand towards G2 Ocean, to get the systems up and running again. In addition, the hackers would have the opportunity to obtain information about the company and the participants in the supply chain. This may be information the participants in the supply chain trust that G2 Ocean protect and keep confidential. If this information had been stolen, this could have led to G2 Ocean as a company weakens their reputation.

Shipping is a conservative industry. To move away from old solution and towards new IT solutions can create fear and insecurity in the supply chain. (VOGDRUP-SCHMIDT, 2015) . It will be important to have a plan that shows why IoT tracking is as safe as the old methods. Informant 5 illuminates a statement that can potentially describe some parts of the market. He/she said that *“it is very difficult to hack a piece of paper”*. He/she illuminates the issue around the implementation of new methods in the industry. There will always be people saying that the old methods are the best.

6.0 Finalization

This section will be a summary of the advantages and disadvantages, this will make the foundation for the conclusion

Advantages	Categorized	Disadvantages	Categorized
No way to withhold information	Trust	No way to tell “white lies” for own gain	Trust - Efficiency
Save miscommunication	Interactions/efficiency	Fewer interactions	Relation/trust
Implement new technology together with customers	Relation - customer advantage	Hacking	Cyber Security – leak of information
Less unnecessary contact with customers	Efficiency - Interactions	Price for the technology	Finance
Reduce “tally” service	Efficiency	More questions if all information shared at same time	Efficiency
Reduce Manual inputs	Efficiency		
Reduce claims handling time	Efficiency		
Establish themselves as a digitalized company	Marketing		
Reduce costs	Finance		

6.1 Conclusion

The spreadsheet above shows advantages and disadvantages of IoT tracking which have been presented in this thesis. The most common advantage is factors that can increase efficiency. The disadvantages are more related to customer relations and trust, meaning the connection between G2O and their customers. It is always a race to be the most efficient actor to get to be the preferred choice.

There is no doubt that this technology has a possibility to bring advantages for G2Ocean, and it is clear that it can be a tool for increased efficiency. The main disadvantage would be if the cost would be too high and if the advantages don't justify the price for implementation. It would also be worth to take into consideration how it would affect their relationships. If this were to be implemented, it would be necessary to measure the advantages up to the disadvantages and figure out what weights the most.

This type of technology will be seen more of in the future. Investments must be made if the advantages dictate that it could be beneficial. To find that out would require further investigation to the topic.

6.2 Suggestion for further research

The research has focused on highlighting advantages and disadvantages to an exciting technology. The focus has not been to highlight one specific advantage or disadvantage, but to explore and present what they are. The outcomes have been presented, and not been specified how it will degenerate, it has only been categorized and explained how it could be an advantage/disadvantage. The next step of investigation to the subject could be digging deeper into each of the results, find specific figures, to sort out if this form of tracking technology is worth implementing. Hopefully, this research has built a foundation for further research and we hope that is something to be seen.

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Attachments

Attachment 1: Interview guide

phase	Theme	interview questions
<p>Warm up</p> <p>Purpose:</p> <p>Get the conversation going</p> <p>Create a safe environment</p> <p>Get relevant information around the subject</p>	<p>Characteristics of the informants</p>	<p>1. Can you tell us about yourself and your role in your company?</p> <p style="padding-left: 40px;">A) Education and experience</p> <p style="padding-left: 40px;">B) work assignment involving customer relations</p> <p>2. What's your thoughts around working close to your customers?</p> <p>3. What is your perception of a good customer relation?</p> <p style="padding-left: 40px;">A) Which factors do you consider as the most important in a customer relationship?</p> <p>4. Can you tell about the focus your company has towards innovation and improving old procedures?</p>

<p>reflection questions</p> <p>purpose:</p> <p>Main questions which requires the informant to reflect.</p>	<p>experience around customer relations</p>	<p>5. How does the supply chain you are a part of look like?</p> <p>6. How often and in which way do you interact with your participants in the supply chain?</p> <p>A) Do you have frequent contact with your customers?</p> <p>B) In which context do you interact with your customers trough the transportation process?</p> <p>C) Has there been a big change in the way you interact with your customers in the last years?</p>
	<p>Cargo Tracking</p>	<p>7. Can you describe your current process on how you track your cargo?</p> <p>A) Do you have a full overview over where the cargo is throughout the entire supply chain?</p> <p>B) Are you satisfied with your cargo tracking system?</p> <p>C) Do you see any potential improvements for your cargo tracking system?</p> <p>8. Do you see any potential improvements for your cargo tracking system?</p>
	<p>IoT cargo tracking</p>	<p>9. Which potential do you see in tracking cargo with IoT technology?</p>

		<p>A) How do you think it could be relevant for your type of cargo?</p> <p>B) How do you see that this technology can be relevant for your company?</p> <p>10. How do you think IoT tracking could affect/change the way you interact with your customers?</p> <p>11. Do you think it could affect the trust relations, when everybody has the visibility of the cargo?</p> <p>13. Do you think a tracking solution would affect the efficiency?</p> <p>A) The administrative efficiency</p> <p>B) The operational efficiency</p> <p>C) Cost efficiency</p>
	<p>Advantages and disadvantages with IoT tracking</p>	<p>14. What do you see as advantages for tracking cargo with IoT technology?</p> <p>15. Which disadvantages could tracking with cargo with IoT technology have?</p>

Conclusion		16. Do you feel that you have more relevant thoughts around this subject, that you could share? 17. Any final punchline around the subject? 18. Can we contact you if we have any follow up questions?
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Attachment 2: Information letter

IOT CARGO TRACKING

This is a question for you, where we wonder if you would like to participate in a research project. The purpose of the project is to take a deeper look into which degree IoT cargo tracking can influence the interaction between carrier and customer?

We will in this note give you information about the project, as well as information about what the participation will involve.

Purpose:

The purpose of this project is to look at the possibilities for a new way of tracking cargo through the whole supply chain. We will specially investigate IoT tracking solutions and see if this is something that can benefit the interactions between customer and carrier.

We want input from various departments within G2 Ocean, as well as their customers, to see what they think about IoT tracking as well as how it could impact the interactions that are being made.

The research project is a bachelor thesis, which is completed at the fifth semester on the shipping management study at NTNU in Aalesund.

Who is responsible for the research project?

Erlend Lilletveit Kvaale and Magnus Oksholm Matre will be responsible for the Bachelor project. Our supervisor from NTNU is Antoni Vike Danielsen.

Why do we want you to participate?

We want to interview you because you are involved in G2 Ocean's supply chain and we would like to hear your thoughts on IoT cargo tracking.

What will your participation consist of?

The contribution will be made through a qualitative interview consisting of the topics mentioned above. If you choose to participate, we would appreciate if we could record the interview. This is done to be able to transcribe the material so we can refer to this in the thesis.

- The interview will take around 30-45min.
- You will not be asked any personal related questions.
- The interview will be recorded.

It is voluntary to participate:

It is voluntary to participate in the project. If you choose to participate, you can withdraw your consent at any time without giving any reason. All your personal information will then be deleted. It will not have any negative consequences for you if you do not want to participate or later choose to withdraw.

Your privacy and how we store and use your information:

We will only use the information about you for the purposes we have described in this article. We treat the information confidentially and in accordance with the privacy regulations.

- Only the project team (Erlend and Magnus) and our supervisor (previous described as responsible for the project) will have access to the raw data we collect from you.
- We will replace your contact information with a code that is stored in a separate name list which is located separate from the other data.
- We will not refer to personal information in the thesis.

participants will not be recognized in the thesis.

What happens to your information when we end the research project?

the information we received during the interview will be deleted after the research project is completed. We expect to end the research project the 16.12.2020.

Your rights

If you can be identified in the data material, you have the right to:

- access to which personal information is registered about you, and to receive a copy of the information.
- to have personal information about you corrected.
- to have personal information about you deleted.
- to send a complaint to the Data Inspectorate about the processing of your personal data.

What gives us rights to use personal data about you in the project?

We process information about you based on your consent.

On behalf of NTNU, NSD(Norsk senter for forskningsdata) has assessed that the processing of personal data in this project is in accordance with the privacy regulations.

Where can you find out more about the project and your rights?

If you have questions about the study, or want to exercise your rights, please contact:

- Erlend Lilletveit Kvåle or Magnus Oksholm Matre: Students from NTNU
- NSD – Norsk senter for forskningsdata AS on E-mail (personverntjenester@nsd.no) or phone: 55 58 21 17.

Best regards

Responsible for the project

Student

Declaration of consent

I have received and understood information about the project about IoT cargo tracking and have had the opportunity to ask questions.

I agree to:

- Participate in the interview
- That my information is stored until the project ends
- I agree that my information will be processed until the project is completed, approx. December 16, 2020
- I agree that the interview will be recorded

(sign by the project participant, date)

Attachment 3: Application to NSD

Prosjekttittel

IoT tracking

Referansenummer

571425

Registrert

09.10.2020 av Erlend Lilletveit Kvåle - erlenlkv@stud.ntnu.no

Behandlingsansvarlig institusjon

Norges teknisk-naturvitenskapelige universitet / Fakultet for ingeniørvitenskap / Institutt for bygg- og miljøteknikk

Prosjektansvarlig (vitenskapelig ansatt/veileder eller stipendiat)

Antoni Vike Danielsen , antoni.v.danielsen@ntnu.no, tlf: 4799121836

Type prosjekt

Studentprosjekt, bachelorstudium

Kontaktinformasjon, student

Erlend Lilletveit Kvåle, erlendlkv@stud.ntnu.no, tlf: 47636380

Prosjektperiode

10.10.2020 - 24.12.2020

Status

22.10.2020 - Vurdert

Vurdering (1)

22.10.2020 - Vurdert

Det er vår vurdering at behandlingen av personopplysninger i prosjektet vil være i samsvar med personvernlovgivningen så fremt den gjennomføres i tråd med det som er dokumentert i meldeskjemaet med vedlegg den 22.10.2020, samt i meldingsdialogen mellom innmelder og NSD. Behandlingen kan starte.

DEL PROSJEKTET MED PROSJEKTANSVARLIG Det er obligatorisk for studenter å dele meldeskjemaet med prosjektansvarlig (veileder). Det gjøres ved å trykke på “Del prosjekt” i meldeskjemaet.

MELD VESENTLIGE ENDRINGER Dersom det skjer vesentlige endringer i behandlingen av personopplysninger, kan det være nødvendig å melde dette til NSD ved å oppdatere meldeskjemaet. Før du melder inn en endring, oppfordrer vi deg til å lese om hvilke type endringer det er nødvendig å melde:

https://nsd.no/personvernombud/meld_prosjekt/meld_endringer.html

Du må vente på svar fra NSD før endringen gjennomføres.

TYPE OPPLYSNINGER OG VARIGHET Prosjektet vil behandle alminnelige kategorier av personopplysninger frem til 24.12.2020.

LOVLIG GRUNNLAG Prosjektet vil innhente samtykke fra de registrerte til behandlingen av personopplysninger. Vår vurdering er at prosjektet legger opp til et samtykke i samsvar med kravene i art. 4 og 7, ved at det er en frivillig, spesifikk, informert og utvetydig bekreftelse som kan dokumenteres, og som den registrerte kan trekke tilbake. Lovlig grunnlag for behandlingen vil dermed være den registrertes samtykke, jf. personvernforordningen art. 6 nr. 1 bokstav a.

PERSONVERNPRINSIPPER NSD vurderer at den planlagte behandlingen av personopplysninger vil følge prinsippene i personvernforordningen om:

- lovlighet, rettferdighet og åpenhet (art. 5.1 a), ved at de registrerte får tilfredsstillende informasjon om og samtykker til behandlingen

“What are the carrier advantages and disadvantages of IoT cargo tracking?”

- formålsbegrensning (art. 5.1 b), ved at personopplysninger samles inn for spesifikke, uttrykkelig angitte og berettigede formål, og ikke behandles til nye, uforenlige formål
- dataminimering (art. 5.1 c), ved at det kun behandles opplysninger som er adekvate, relevante og nødvendige for formålet med prosjektet
- lagringsbegrensning (art. 5.1 e), ved at personopplysningene ikke lagres lengre enn nødvendig for å oppfylle formålet

DE REGISTRERTES RETTIGHETER Så lenge de registrerte kan identifiseres i datamaterialet vil de ha følgende rettigheter: åpenhet (art. 12), informasjon (art. 13), innsyn (art. 15), retting (art. 16), sletting (art. 17), begrensning (art. 18), underretning (art. 19), dataportabilitet (art. 20).

NSD vurderer at informasjonen om behandlingen som de registrerte vil motta oppfyller lovens krav til form og innhold, jf. art. 12.1 og art. 13.

Vi minner om at hvis en registrert tar kontakt om sine rettigheter, har behandlingsansvarlig institusjon plikt til å svare innen en måned.

FØLG DIN INSTITUSJONS RETNINGSLINJER NSD legger til grunn at behandlingen oppfyller kravene i personvernforordningen om riktighet (art. 5.1 d), integritet og konfidensialitet (art. 5.1. f) og sikkerhet (art. 32).

For å forsikre dere om at kravene oppfylles, må dere følge interne retningslinjer og/eller rådføre dere med behandlingsansvarlig institusjon.

OPPFØLGING AV PROSJEKTET NSD vil følge opp ved planlagt avslutning for å avklare om behandlingen av personopplysningene er avsluttet.

Lykke til med prosjektet!

Tlf. Personverntjenester: 55 58 21 17 (tast 1)