What role will blockchain play within the maritime shipping industry in five years?

- A study using scenario planning to identify indicators of future industry transformation

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Public interest statement

This thesis is intended to improve your understanding for the future of maritime shipping and in what way blockchain is a part of that future, you should definitely put your energy into taking part of the scenarios presented in section 6.6 in this report. Business managers or maritime logistics enthusiasts are recommended to use the constructed scenarios as a source of industry insights and wide coverage of potential future events, rather than exact predictions. The results are intended to be a managerial tool for guiding future strategic actions, but also acting as a contribution to the sparse research of the blockchain technology within a maritime shipping context as well as adding theoretical experience of using a scenario planning analysis approach.

Abstract

The strong majority of the total carriage within global trade today is seaborne. Huge amounts of goods are handled and transported with maritime shipping everyday, making the industry one of the more prominent in terms of affecting the global economy. Albeit such an impactful global player and vital component for the global economy, the industry still struggles with patterns of conservatism, manual handling as well as a relatively low pace of technological change. One of the technological forces that have been identified as a potential candidate for impacting the maritime shipping industry within five years is blockchain, however, no consensus is yet established in regards to what such a future will behold or what role the technology will play within the industry. Blockchain is a distributed ledger technology, a system that distributes data through electronic transaction without the need for a third-party responsible for validating transactions. Within blockchains, all transactions can be traced, and they enable higher levels of security as it is difficult to tamper with the transactions. The possibilities of blockchain are therefore many and it creates an interesting dimension in terms of how its characteristics are suited in a future context of an industry valuing traditions and displaying a cultural barrier to change. Hence, the thesis is aimed at investigating what role blockchain technology might have within the maritime shipping industry in five years.

To reach the purpose of this thesis, a scenario planning analysis has been conducted. Scenario planning is a valuable tool in achieving a greater understanding of the future within industries experiencing a great level of uncertainty and industries that are going through change, such as the maritime shipping industry. From the study, two development factors emerged to be most likely to have a significant influence on the industry and the future role of blockchain: if the pattern of trust is based on traditional business relationships or technological solutions, and what level of transparency evident within industry value chains. The scenario planning analysis resulted in four plausible future scenarios for the industry where blockchain technology play different roles depending on the pattern of trust and the level of transparency. The thesis concludes that blockchain can provide significant value in a scenario where trust is based on technology and the level of transparency is high. Furthermore, it can provide somewhat value in the scenarios where the pattern of trust is based on technology and the level of transparency is low, or the opposite. Lastly, the study found that blockchain cannot provide value in a scenario where the pattern of trust is based on traditional values and the level of transparency is low. With these results in mind, managers and enthusiasts receive insights of future plausible scenarios for the maritime shipping industry and academics receive practical applications of scenario planning as well as contribution to the sparse research on blockchain within a maritime shipping context.

Key words Maritime shipping, Blockchain, Scenario planning, Blockchain in maritime shipping, Scenario planning analysis, Scenario building

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Thanks to..

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Abbreviations

AI: Artificial intelligence
B/L: Bill of Lading
B2B: Business-to-Business
B2C: Business-to-Consumer
CO2: Carbon dioxide
ICS: International Chamber of Shipping
IT: Information Technology
IOT: Internet-of-Things
IMO: International Maritime Organization
LCC: Letter of Credit
MRV: Monitoring, reporting and verification
MTI: Maritime Transport International
SME: Small- and medium sized enterprises
UNCTAD: United Nations Conference on Trade and Development
VGM: Verified Gross Mass

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1. Introduction

1.1. Background

The climate in the international trade environment is in a state of constant change. Globalization is a powerful force rapidly paving through industries and new processes and business nuances are taken shape in the wake of such development. One of the most vital components of globalization and the progress in the global economy is transportation, enabling both globalization and international trade by moving tremendous amounts of goods or individuals across distant global regions (Rodrigue, 2007). Transportation activities does not only impact the availability of raw materials or finished goods, but also the movement of workforce or consumers, ultimately affecting the entire global market and the consumption patterns present within the international trade context. The movement of goods between different geographical locations are vital for the global economy (Rondinelli & Berry, 2000) and transportation hence works as a highly supporting force in enabling the global economy to move forward, making trade and transportation two coexisting forces impacting one another.

As the geographical space that needs to be overcome for actors active within global trade is extensive, several transportation modes exist which are together shaping long and complex transportation chains to move goods or people across the globe. Due to the fact that global trade calls for long distance transportation, one of the most significant modes of transportation is maritime transport (Rodrigue, 2007). According to the International Chamber of Shipping (ICS) maritime transport represents approximately 90 percent of the total carriage within global trade (ICS, 2018), making the shipping industry a vital component within the global economy. Maritime transport activities have increased in power due to reasons such as trade liberalizations enabled by globalization and improvements in the management of shipping operations (Corbett & Winebrake, 2008). The maritime shipping industry development is therefore highly interesting to observe as changes within the specific industry have implications for the whole of the global economy.

One of the more prominent forces shaping the scope of global trade is technology, both in revolutionizing the way business and trade is conducted as well as spurring the development of new businesses and new characters of value chains (Kagermann, 2014). Maritime shipping is going through significant technological changes and effort is put into this process from many different actors. The international Maritime Organization (IMO) is an UN-agency working actively with safety and security within the shipping industry, supporting electronic data exchange between different parties as well as improvement in shipping operations in terms of efficiency and communication (IMO, 2019a). Although heavily regulated by the government, agency actions are taken in order to improve industry operations and activities further. The maritime shipping industry is hence an industry going through extensive change, where the effects of new technologies have not yet fully been explored (UNCTAD/DTL/2018/1, 2018; Berg & Hauer, 2015).

The shipping industry is slowly going from being characterized by relatively traditional activities and processes, to being highly impacted by digitization and technological development. Processes that not that long ago were viewed to be impossible is no longer out of reach, such as crewless shipping and technological restructuring of global supply chains (PWC, 2017). Several technological forces can be identified within the maritime shipping industry context. Trends such as big data (Zaman, Pazouki, Norman, Younessi & Coleman, 2017; UNCTAD/DTL/2018/1, 2018) and Artificial Intelligence (AI)(Cardwell, 2018; Fruth & Teuteberg, 2017; PwC, 2017). In addition, trends such as AI and big data, one technological force that is predicted to impact the shipping industry is blockchain technology. In a study conducted by the United Nations Conference on Trade and Development (UNCTAD/DTL/2018/1, 2018), 50 percent of the respondents constituting of experts within this field of research reported that they believed that blockchain technology will have a significant impact on maritime trade patterns within the next five years.

Blockchain is a technological system which distributes data through electronic transactions without having a centralized third actor responsible for the transaction, such as a bank, to verify the validity of the transaction (Nofer, Gomber, Hinz & Schiereck, 2017; Seiffert-Murphy, 2018). Blockchain is thus a promising technology in streamlining operations and enable faster and more secure transfer of data between different actors. Initiatives to implement blockchain have already been taken within the industry of maritime shipping, one of the more frequently mentioned examples is a collaboration between the companies Maersk and IBM who have created a common platform called Tradelens. Tradelens is based on blockchain technology and is intended to support paperless, secure and efficient trade operations (Tradelens, 2019). The innovative platform is intended to positively affect all actors within global shipping chains and standardize communication (Ibid).

There are different types of blockchain designs providing different user accessibility, ranging from public access where any individual or organization can access the system, to private chains where accessibility is limited to one organization (Zheng, Xie, Dai, Chen & Wang, 2018). The different levels of access provide different challenges and opportunities depending on the specific context to which they are applied. However, although new technologies might present a wide range of opportunities for the actors within the industry, challenges and concerns also need to be addressed. The role that future technologies will play within the transportation industry as a whole will be dependent on the problems evident in the industry (Nijkamp et al., 2000), and blockchain technology can be argued to be one of the innovative ideas with great potential in solving such problems.

1.2 Problem discussion

As the maritime shipping industry is on the verge of potentially radical changes, uncertainty and rapidly adjusting industry conditions puts major constraints on the industry players in how to respond to such an uncertain future. The industry has long been characterized by traditional, and somewhat ancient, processes (UNCTAD/DTL/2018/1, 2018) which are now being defied by the introduction of new technologies. In addition to this, new regulations will most likely have a major impact in how maritime shipping operations will be developed which will further

affect the dynamics in the transport value chains. One of the most interesting technologies to study in this industry context is blockchain technology, which is argued to potentially impact the industry within the next five years (UNCTAD/DTL/2018/1, 2018). Carrying tremendous volumes of goods across the globe with high value, implementing such technology in a maritime shipping value chain could potentially increase security for all parties (UNCTAD/DTL/2018/1, 2018), help implement global shipping process standards (UNCTAD/DTL/2018/1, 2018), ease the collection of data needed from new regulations (MTI, 2018) as well as increase efficiency in combination with lowered costs (UNCTAD/DTL/2018/1, 2018; Seiffert-Murphy, 2018; Cardwell, 2018).

As of today, no consensus is established surrounding what role blockchain will have within the maritime shipping industry. Although initiatives have been taken (Tradelens, 2019; MTI, 2018; DNVGL, 2019), these are only newly started projects by which impact or results are yet not fully explored. As the maritime shipping industry constitutes one of the most significant actors within global transport (UNCTAD/LTD/2018/1, 2018) where potential change in such operations and technological investments impacts the global economy, the industry is a highly interesting area to investigate. Exploring how blockchain technology might impact the maritime shipping industry is hence important as it sheds light into the future state of the industry, and organizations can use the knowledge in guiding their strategic actions. Furthermore, investigating the future of the maritime shipping industry contributes to the sparse research surrounding blockchain technology in a future maritime shipping context.

Research context

The thesis is conducted with gathered inspiration and contact with a line agent company working in Gothenburg. Due to confidentiality requests, the company will remain anonymous. The discussion has provided the authors with some guidance and insight when selecting the focus of the thesis as well as a realistic interpretation of industry characteristics, which is considered beneficial for the study. The company has expressed that a more general scenario illustration, identifying the major industry changes rather than focusing on highly detailed descriptions, is of value. Because of this, the thesis will not be focused on a specific business area within the industry.

Research purpose

The purpose of this thesis is to investigate what role blockchain technology might have within the maritime shipping industry in five years. The result from the study is ambitioned to guide future strategic actions and enable companies in finding suitable responses to uncertainties in the changing business climate. In order to do this, the authors are going to construct scenarios which represent potential future industry situations. The thesis will contribute to a greater understanding of the benefits or challenges connected to implementing blockchain in a global maritime shipping setting, a topic that is, as of today, both lacking in quantity and concrete representations of the potential future state of the industry. The study will therefore contribute to the lacking consensus within academia as well as in reducing the uncertainty in managerial strategic actions within business contexts.

1.3 Research question

In order to investigate what role blockchain technology might have within the maritime shipping industry in five years, the following research question will be examined:

What is the potential role of blockchain technology within the maritime shipping industry in five years?

The methodology used in order to answer the research question will be described in section 3 and further motivated in section 4.

1.3.1 Delimitations

For the thesis, limits in terms of time and resources have called for a set of delimitations to be applied. Firstly, there are several different types of scenario planning methods stemming from different viewpoints. They therefore have different approaches to identifying and constructing scenarios. For example, probabilistic methods focus on assigning probabilities which lies as a foundation for best-case or worst-case scenarios (Ramirez, Churchhouse, Palermo & Hoffmann, 2017). However, the approach taken in this report is what Ramirez et al. (2017) calls "Oxford Scenario Planning Approach", emphasizing *plausibility instead of probability*. The authors argue that since the examined industry is characterized by changing business conditions and a high level of uncertainty, it is important to recognize that some of the uncertainties and their outcomes cannot be fully predicted. The focus should instead lie on generating new insights and knowledge.

Secondly, the scenario planning method is applied within a *five-year time frame*. The authors have chosen that specific time frame based on two dimensions; practise within scenario planning as well as expert estimations. Two usually applied timeframes within scenario planning is five or ten years (Garvin & Levesque, 2005), there is thus a methodological motivation for applying a five-year time frame. In addition to this, the authors have taken Gartner's Hype Cycle for emerging technologies into consideration. This is an illustration of different technologies and what levels they are at in terms of implementation and the likely time frame to by which they have reached full productivity (Gartner.com, 2019). In the case of blockchain technology, they have predicted a 5-10-year time frame (Gartner.com, 2018). Furthermore, industry experts are predicting that blockchain technology will most likely have a great impact on the maritime shipping industry within five years (UNCTAD/DTL/2018/1, 2018) which makes the authors argue that five years functions as a suitable time frame for this study. Third and lastly, the thesis will mainly focus on the non-physical flow within the industry i.e. value chains consisting of information and data rather than the movement of physical products.

1.4 Disposition of study

The overall thesis is divided into seven main parts intended to reflect the different dimensions of the research as well as the sequence of activities, in order to improve the flow of the report and hence the reader's understanding. The introductory part of the thesis has included a background description, motivation for the study and the purpose and research question. The

six remaining parts of the thesis are: *Literature review, Theoretical framework, Methodology, Empirical findings, Scenario planning and Conclusions*. All seven of the main sections are described below and summarized in figure 1.

Literature review: The literature review consists of findings regarding blockchain technology and the potential of application within the industry which lies as the foundation for the main conclusive arguments and the overall findings in the report. This section lies as the foundation for the interview guide.

Theoretical framework: In the section presenting and describing the theoretical framework, the reader can take part in the underlying theories used as the foundation for the applied scenario planning framework. This section is intended to shed light into the theory applied as the research method for this thesis. Furthermore, this section includes the applied scenario planning framework.

Methodology: The methodological section includes a thorough description of the chosen research procedure as well as motivation for why certain procedures or actions have been taken during the process. The methodology description includes an introductory part to the research procedure, the chosen research strategy, the chosen research design, how the data has been gathered and analyzed, as well as the research quality.

Empirical findings: In this section, the reader can take part in the results from the empirical discussion, i.e. the gathered primary data used in the thesis. This section was designed in order to fit the scenario planning method and structured in a way to improve the patterns in the gathered data. This section lies as the foundation for the scenario planning section below.

Scenario planning: The scenario planning section displays the actual scenario planning process that has been applied in this thesis. It includes definition of the scope, identification of trends and uncertainties within the industry, correlations between the findings, construction of scenario themes and lastly the creation of scenario storylines. This section also includes implications for future research and the limitations to the study.

Conclusions: The last section includes a conclusive answer to the research question stated in the first section, as well as a summary of the most valuable points from the overall thesis as well as its implications.

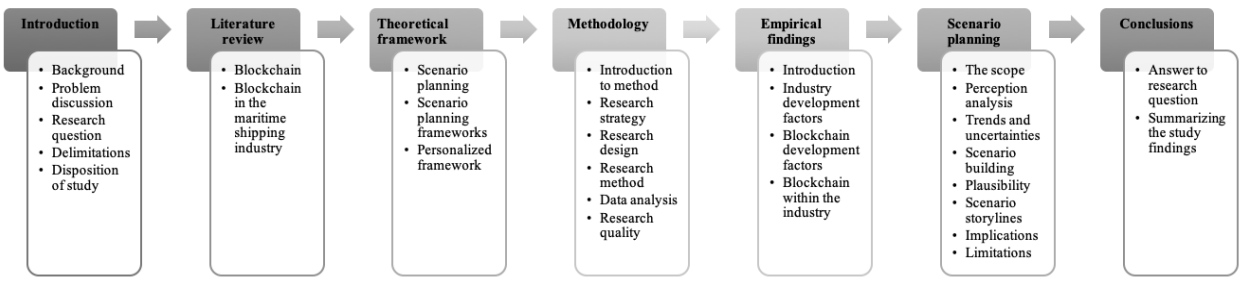

Figure 1: Illustration of the disposition of the thesis

2. Literature review

2.1 Blockchain

2.1.1 What is blockchain?

Blockchain is a distributed ledger technology which originates from the cryptocurrency Bitcoin (Yermack, 2017). The idea behind blockchain is that the system can provide electronic transactions without being dependent on a third actor for validation (Seiffert-Murphy, 2018). Instead of having a third trusted actor, blockchain makes the electronic transaction through different blocks that together provides a complete ledger of the history of that transaction (Nofer, Gomber, Hinz & Schiereck, 2017). To provide the trust that the third actor normally provides, the blockchain will validate the ledger through cryptographic means (Ibid). The cryptographic means will provide the system with a high degree of security, which is one of the most important aspects of blockchain (Feng, Zhang, Chen & Lou, 2018).

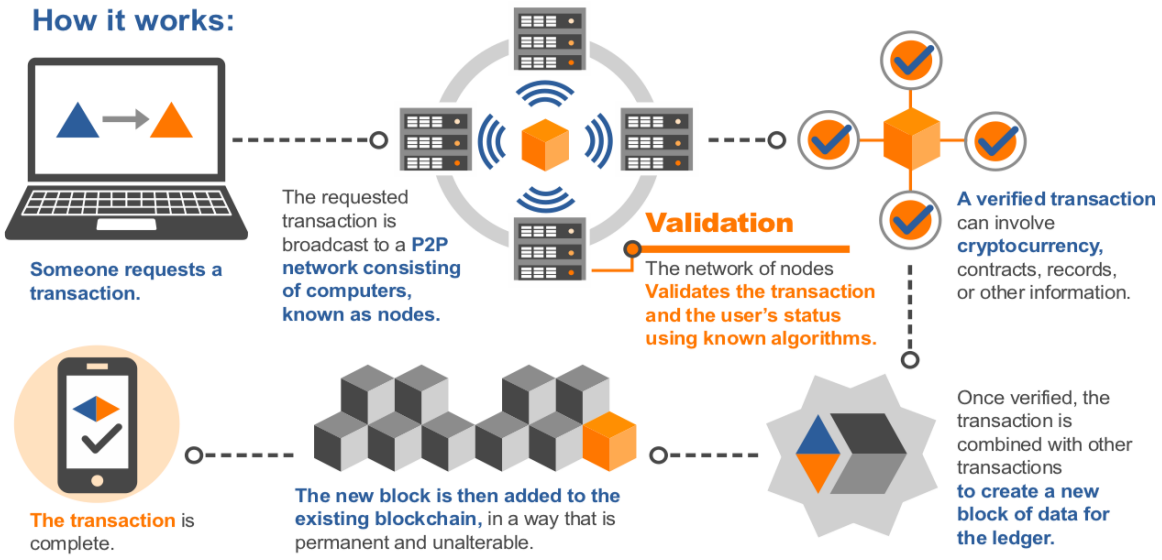

Figure 2: Illustration of blockchain technology (PWC, n.d.)

Key characteristics of blockchain

For the companies and industries that use blockchain, the advantages that can be expected are mainly cost savings and increased efficiency (Zheng et al, 2018). The advantages are reached through the technology's key characteristics: decentralization, persistency, anonymity and auditability (ibid). By avoiding centralization of data, the trusted third-party agency is not needed and therefore cost savings are enabled (Saberi, Kouhizadeh, Sarkis & Shen, 2018). It is also possible to avoid performance bottlenecks caused by the trusted agency, hence blockchain increases the efficiency (Zheng et al, 2018; Saberi et al, 2018). The persistency in blockchain concerns the difficulty of tampering with it (Zheng et al, 2018). Due to the process of validating transactions, it has become difficult to tamper with the blocks of transactions (Yli-Huumo, Ko, Choi, Park & Smolander, 2016). One additional key characteristic of blockchain is anonymity (Zheng et al, 2018), even though the anonymity depends on which type of blockchain that is used (Feng, Zhang, Chen & Lou, 2018). The last key characteristic of blockchain is auditability,

which entails the simplicity of verifying and tracing previous transactions (Zheng et al, 2018). The real-time transparency that blockchain provides through its auditability is very important as it enables organizations to make decisions based on correct data and reach time efficiencies (Nicolett, 2018; Seiffert-Murphy, 2018). This can potentially result in cost savings due to both faster decision-making but also by minimizing decision errors as the decisions are based on correct data (Ko, Lee & Ryu, 2018).

2.1.2 Types of blockchain

Blockchain technology can be divided into two main categories; permissionless and permissioned. Within the two categories there are three types; public, consortium and private blockchain (Arsov, 2017; Bano, Sonnino, Al-Bassam, Azouvi, McCorry, Meiklejohn & Danezis, 2017). A public blockchain is a permissionless blockchain while consortium and private blockchains are permissioned blockchains (Arsov, 2017; Bano et al, 2017). Each category carries different benefits and disadvantages which makes different designs having more or less potential depending on which context to which they are applied (Zheng et al, 2018). To identify if permissioned or permissionless blockchains are most suitable for an organization, its dependents on several factors. For example, it depends on the number of participants, the exchanged assets' value and the importance of having authorized participants (Ksherti, 2017).

Permissionless blockchain

A blockchain that is permissionless is constructed so that anyone can add a block of transaction which means that anyone can validate a transaction within the chain (Walport, 2016; Christidis & Devetsikjoti, 2016). A permissionless blockchain can be seen as the original blockchain and therefore the purest form of the technology (Brennan & Lunn, 2016; Ducas & Wilner, 2017; Arsov, 2017; Bano et al, 2017; O'Leary, 2017). The highest level of security can be found in a permissionless design because the authority is fully developed as there is no party controlling the participation (Brennan & Lunn, 2016). The permissionless blockchain is not dependent on trust since no participants can control the network, instead the permissionless blockchain is dependent on a consensus algorithm (Bauman, Lindblom & Olsson, 2016; Feng et al, 2018; Zheng et al, 2018). Due to the number of transaction blocks there is in a permissionless blockchain, the efficiency in the consensus process is lower than what it is for a permissioned blockchain (Nofer et al, 2017). The consensus process is based on that a majority of validators validates the transactions according to the criteria set for the blockchain (ibid). The security is higher as transactions are validated by multiple actors following criteria negotiated for the blockchain (Brennan & Lunn, 2016). Within permissionless there is only one type of blockchain, namely public blockchains. The most known blockchain system is Bitcoin and that is an example of a public blockchain, meaning that anyone can access the system (Bauman et al, 2016; Walport, 2016; Arsov, 2017; Brennan & Lunn, 2016; Berke, 2016; Dinh, Wang, Chen, Liu, Ooi & Tan, 2017; Bano et al, 2017).

Permissioned blockchains

In a permissioned blockchain, there is a centralized authority that grants access to each actor in the chain, meaning that the chain is restricted (O'Leary, 2017; Ksherti, 2017; Christidis,

2016). In permissioned blockchains, the identity is not anonymous (Kshertri, 2017; Dinh et al, 2017; Bano et al, 2017). Another characteristic of the permissioned blockchain in comparison to the permissionless blockchain is that it is not as decentralized due to the fact that there is a centralized authority present (Ducas & Wilner, 2017). The consensus process for a permissioned blockchain is much simpler than for permissionless blockchains, this because there are trusted actors which will approve the integrity (Arsov, 2017). In permissioned blockchains the number of transaction blocks are normally lower, which will increase the efficiency in the consensus process compared to the efficiency for permissionless blockchain consensus (Nofer et al, 2017). In permissioned blockchain it is the central authority/authorities that provides the validation (Kremenova & Gajdos, 2019). Therefore, permissioned blockchain can be considered to be more adapted in terms of fitting into a business context (Brennan, 2016). There are two different types of permissioned blockchains; private or consortium (O'Leary, 2017; Zheng et al, 2018; Seiffert-Murphy, 2018).

Private blockchains are normally active within one organization and are used for internal purposes (Bauman et al, 2016; O'Leary, 2017). As previously mentioned, anonymity does not exist in permissioned blockchains, and especially not in private blockchains (Kshertri, 2017; Dinh et al, 2017; Bano et al, 2017). In private blockchains, Ducas and Wilner (2017) argues that the participant's identity is crucial, and that trust is created through the central authority. Consortium blockchains are similar to private blockchains but are intended to be used between different organizations. The major difference is that the chain is not fully controlled by one organization (Zheng, Xie, Dai, Chen & Wang, 2017). Therefore, the blockchain system becomes more decentralized compared to private blockchains, but still more centralized than a public blockchain (Zheng et al, 2017; Arsov, 2017; O'Leary, 2017). A disadvantage with a consortium blockchain compared to a public one is that the risk of tampering is increased because of the number of authorities (Zheng et al, 2017). A consortium blockchain is appropriate to use for external business contexts due to the possibility to restrict access but still gain efficiency and cost savings (Zheng et al, 2017; Bauman et al, 2016; O'Leary, 2017).

2.1.3 Concerns with blockchain

Scalability is one of the concerns for the adoption of blockchain within industries (Bano et al., 2017). Scalability is the system's ability to produce greater output when it involves a larger amount of participants and a larger amount of transactions (Bano et al, 2017; Chauhan, Malviya, Verma, Mor, 2018). For example, the scalability goes down when a transaction needs to go through many different nodes even though the security would increase (Bano et al., 2017; Chauhan, Malviya, Verma & Mor, 2018). According to Brennan (2016), there is also a concern that the cost savings that blockchain provides through its efficiency can be competed away by the technology becoming a necessary tool for companies to survive. This creates a concern for when to invest in the technology and if the technology will create a disruptive change or not (Brennan, 2016).

Trends

Blockchain is a novel technology which has yet to be fully implemented in any industry. However, there are some emerging trends of the technology and its applications. One of the

main interests of blockchain technology is the potential to applicate it within an Internet-of-Things (IoT) context (Marr, 2019; Rands, 2018; Bussman, 2019). Several different services, actors and devices all connected in order to create and store data simultaneously in the same overall system is a big opportunity (Rands, 2018). Blockchain and its powerful encryption capabilities can also be used in order to secure connected data and devices as a lot of force is needed for an attacker to break in (Marr, 2019). As communication between devices will continue to grow the need to log this communication, to trace it and to keep track of such transaction is also needed.

Another blockchain trend of high interest is the enabling of decentralized ecosystem platforms (Bussman, 2018) which entails having actors in an entire value chain interconnected in a standardized and common interface. This will further entail a higher level of industry cooperation where the involved players can together bring end-to-end services as well as creating new types of business models (Bussman, 2019). Blockchain initiatives are hoping to provide a more thought-through and secure value chain of actors where the different participants might receive live information, tracing products that are default and tracing origin (Marr, 2019). Furthermore, one of the main blockchain trends is designing smart contracts and how they can be applied to different business contexts (Marr, 2019; Rands, 2018). Blockchain technology in this sense has the power to potentially make third parties involved in business processes redundant, such as bankers or other financial intermediaries (Rands, 2018).

2.2 Blockchain in the maritime shipping industry

2.2.1 Industry characteristics

The maritime shipping industry is one of the industries which has kept many traditional processes in their operations. The industry is characterized by highly time-consuming processes which are heavily document-based, especially in terms of physical papers, and these documents involves many different parties in a long chain of participants (Watson Farley & Williams, 2018). These long chains of involved actors that are taken part in the different document exchanges increases both the risk of someone actually committing errors leading to delays or extra costs, but also fraud (ibid). In addition to this the transport mode itself often calls for physical double-handling, i.e. handling goods more times than necessary, as many parties are involved, especially in shorter freight distances (Rushton et al., 2010). Leviäkangas (2016) argues that digitization as a general force are one of the main technological developments that have impacted, and is continuing to impact, the trade and transport industry. Leviäkangas (2016) further argues that one of the main challenges created from the digitization trend within the transport industry is for participant, both regulators as well as business organizations, to identify and determine global shipping standards. More specifically, operations for shipping goods overseas in regard to bill of ladings and other transport documents should be globally standardized.

The maritime shipping industry is highly affected by regulating forces and legislation. The major organizations that are affecting the regulation of the industry are the European Union and International Maritime Organization (IMO). One of the more recent changes in regulation is the “Monitoring, Reporting and Verification” (MRV) initiative taken by the European Union,

a protocol aimed at lowering the CO2 emissions created from maritime shipping by requiring shipping companies to monitor and report their emissions for vessels over 5000 gross tonnage (DNVGL, 2019). The monitored CO2-emission data shall be verified by an independent part and then reported to European Maritime Safety Agency (EMSA) all together with other data (DNVGL, 2019). In addition to this, IMO implemented the concept of "Verified Gross Mass" (VGM) in 2016 which basically states that no containers are allowed to be brought onto a vessel without its weight been verified (IMO, 2019b). Hence, the weight of the containers is required to be reported to the terminal before loading (IMO, 2019b).

Development

There are several development patterns evident within the industry. Firstly, there is an overall consolidation trend within the industry where the smaller actors are pushed out of the markets and the few major players are becoming more powerful by creating strategic alliances and acquisitions (Wiklund, 2018; UNCTAD/RMT/2017, 2017; Gonen, 2018; Laxmana, 2018). This might negatively affect the service quality and increase prices if the major markets players are abusing their market power (UNCTAD/RMT/2017, 2017). Secondly, even though the industry is relatively traditional, technology is a strong trend challenging the prevailing value chains (UNCTAD/RMT/2017, 2017; Laxmana, 2018) where blockchain technology is one that is frequently mentioned as of high interest (UNCTAD/RMT/2017, 2017; SHM, 2018). Furthermore, one of the major trends within the industry is data analytics and big data analysis (Mishra, 2018; UNCTAD/RMT/2017, 2017; IHS, 2017). Due to technological advances there is a higher degree of accessibility to various shipping data, data analytics will continue to become more evident within the industry. Tracking vessels, finding optimal routes and applying information directly in documentation processes are all options available due to such development (IHS, 2017).

Another trend that is evident within the shipping industry is continuously increasing volumes that is being transported, this due to the demographic shifts and increased purchasing power in developing countries (IHS, 2017; UNCTAD/RMT/2017, 2017). Customer demand for accuracy is also being reinforced as growing consumption and increased incomes worldwide creates a need for high-quality and fast-access transportation opportunities in order to achieve a sufficient level of customer satisfaction (Mishra, 2018). A growing trend within the industry, as in the majority of all industries, is aspirations for green shipping and a more sustainable transportation mode in general (UNCTAD/RMT/2017, 2017; SHM, 2018) where lower emissions are strived towards. This sustainability focus creates a need for companies to know how to comply with new sustainability regulations (UNCTAD/RMT/2017, 2017). Lastly, more agile supply chains are a trend where there is a need for actors to communicate for efficiently. Linking all the different actors and vessels connected systems might improve both operations and product management (Mishra, 2018).

2.2.2 Blockchain and maritime shipping processes

With a continuously evolving and growing digitalization trend within global trade and global shipping operations, blockchain technology is one of the identified technological trends that has potential to disrupt traditional operations, mainly in regard to shipping documentation and

within relationships between different parties involved in such transactions (UNCTAD/DTL/2018/1, 2018). As already explained in the previous section, the maritime transport industry has many different parties involved in their value chains, where documents usually travel long ways and are manually created (Opeansea, 2017). The prevailing documentation processes inherent within the traditional industry could potentially be revolutionized if blockchain is implemented within the industry value chains. The main documents used in maritime transport are: Bill of Lading (B/L), Letters of Credit (LC), Certificates of Origin, commercial invoices and packing lists (Rushton et al., 2010). Further descriptions of the different documents can be found in Appendix 3.

With a potential application of blockchain within the industry, extensive documentation processes might become almost paperless, all the different parties can improve communication and contact, adjust physical transactions and exchanges of information and add contractual obligations (Opensea, 2017). This could not only improve efficiency in the operations and transaction of information between the different parties but also decrease errors due to manual handling. Furthermore, using blockchain where different parties' databases does not remain separate, the usage of "smart contracts" are enabled (ibid). These contracts automatically adjust to the terms and conditions agreed upon in the legal contract and self-executes after negotiations have been conducted through the blockchain network and all parties can validate changes or updates and therefore decreases the need for third party transaction involvement (ibid).

Using blockchain can most likely affect different actors within the industry in different ways, the industry contains long value chains including many actors and the different roles might change or evolve. A further description of industry value chains is presented in Appendix 3. Reports for instance suggests that developments within the industry calls for improved relationships and cooperative efforts between the ports and their stakeholders due to higher pressure on cost efficiency and increased competitiveness (UNCTAD/RMT/2017, 2017). New technological solutions, if relevant to the operations, should be considered in order to improve efficiency and communication as information shared between the different parties is highly important (ibid). Efforts should hence be made into collecting relevant data and ensuring high quality in data collection processes which enables lower costs connected to such processes as well as final analysis of the data (ibid). Furthermore, as transported cargo volumes are increasing there is a growing need for port operations that are modernized and improved in regard to security and technologies (ibid).

One of the positive sides to blockchain is the potential to improve the security and the value in a buyer-seller relationship, however, third parties involved (bankers, freight forwarders etc) might become redundant with the same business model (UNCTAD/DTL/2018/1, 2018). Blockchain technology is anticipated to be more forcefully implemented and adopted by industry players as soon as launched pilot projects, evident within the business environment today, has worked out all of the bugs inherited in the new technology (ibid). Blockchain can enable a high level of trust in the different transactions between the parties, functioning as a shared ledger where all of the involved parties can be safely identified (ibid). Researchers argue

that perhaps the most efficient adoption will be within permissioned blockchains, where prior relationships between the actors exists or where new relationships are formed and needs to be fully secured (ibid).

One example of many recent initiatives that have been taken within the industry in regards to the technology is the company CargoX which offers the service of blockchain-based bill of ladings, aimed at reducing the bill of lading transfer time from 5-10 days to 20 seconds (Cargox, 2018). Instead of the traditional physical movement of the transport documents, which needs to follow the goods and ultimately be received physically by the goods' recipient, the document is instantly moved in the blockchain (ibid.). The blockchain-based bill of lading does not only save money as such movements of physical documents are costly and complex, it also enables a higher level of eco-friendliness due to the transaction being paperless as well as higher levels of security due to the traceability in all transactions (ibid). In addition to this, other benefits such as higher degree of transparency and autonomy in processes will occur (Watson Farley & Williams, 2018; Opeansea, 2017).

Maritime Transport International (MTI) is an organization that has actively working with technology within the industry and are trying to implement blockchain technology to different parts of the value chain. One of their initiatives is to use blockchain for the new regulation VGM implemented by the IMO in 2016, intended to enable organizations to be compliant with the new regulations by streamlining information between all of the involved parties, making sure that the gross weights and other data is reported before loaded on the ship (MTI, 2018). Hence, the industry is heavily regulated which requires capabilities to gather the right data and to do so within a certain amount of time, blockchain is therefore a great opportunity to retrieve large amounts of data and streamline that reporting of such to all of the concerned parties. However, there are some challenges to implementing blockchain within the maritime shipping industry as well. One of the challenges is how scalable the technology is, meaning that true adoption will most likely depend on the synergies and relationship between industry actors (UNCTAD/DTL/2018, 2018). The maritime transport industry is, as already mentioned, characterized by complex processes. This means that there is an overall low standardization within industry, i.e. different actors have widely different contractual agreements in regard to terms and conditions, as well as a need for high flexibility in operations due to often occurring delays or errors (Opeansea, 2017).

Blockchain	**Industry**	**Blockchain in industry**
Scalability	Consolidation	Streamlining operations
Value chains	Technology	Organizational capability
Transparency	Transport volumes	Smart contracts
Security	Documentation	Data analytics
Blockchain design	Regulations	
	Business relationships	
	Sustainability	
	Conservatism	

Table 1: A summary of development factors that have been identified within the literature review.

3. Theoretical framework

3.1 Scenario planning

3.1.1 What is scenario planning?

Most individuals are familiar with the rapid change most industries going through today. Industries today are under high levels of pressure from increasing complexity as well as volatility, which is causing an overall increase of uncertainty in the business environment (Schwenker & Wulf, 2013). One way of coping with such a high degree of rapid change and uncertainty is scenario planning (Schoemaker, 1995; Schwenker & Wulf, 2013; Lindgren & Bandhold, 2003, Ramirez et al., 2017). Scenario planning is a tool that can be used for exercising strategic thinking within an organization (Schoemaker, 1995), and by developing a set of different strategic options it enables companies to be flexible and to easier adapt to changing conditions (Schwenker & Wulf, 2013). Scenario planning is thus a valuable resource that can be used in order to exert higher levels of control over the ever so rapidly changing business climate in the majority of today's industries.

Ramirez et al. (2017) presents scenario planning as a way of constructing plausible scenarios, based on plausible future events both in the external as well as internal environment surrounding an organization. These scenarios functions as the foundation for long-term strategic reframing. One of the more important features or characteristics of scenario planning in relation to traditional forecasting is that scenario analysis both recognizes and emphasizes the creation of plausible futures, rather than trying to exactly predict future events (Enzmann et al., 2011). This emphasis and procedure enable a more accurate hit rate as including several different plausible scenarios covers a wider area of possible happenings, instead of a more narrow scenario aimed at being entirely accurate.

Lindgren & Bandhold (2003) presents seven different criterias for the construction of scenarios intended to be used in strategic purposes, which are important to consider when conducting scenario planning analysis. For example, the scenarios should lie as the foundation for decision-making, the scenarios should be plausible and realistic, the scenarios should be based on a certain probability of occurring and the scenarios should be logic in a sense of being internally viable and consistent in sequence of events. Furthermore, Ramirez et al. (2017) argues for mainly three important criteria in order to construct effective scenarios; the importance of including multiple parties into the process, understanding the plausibility-dimension of the process i.e. focusing on likelihood of events instead of probability of something occurring, and understanding how important it is to set aside both time and resources in order to reach as high level of quality as desired.

Scenario planning is mainly about challenging prevailing mindsets (Shoemaker, 1995; Lindgren & Bandhold, 2003; Ramirez et al., 2017, Enzmann et al., 2011; Chermack et al., 2001) which are inevitably inherent in organizations and decision-making contexts. Shoemaker (1995) argues that there are two major pitfalls in prediction activities and forecasting which can be somewhat mitigated with scenario planning, namely being overconfident in the predictions as well as being biased in the predictions, i.e. having tunnel vision in such activities.

Scenario planning compensates the two common pitfalls by simplifying the process of collecting and separating data into different scenarios as well as the potential effects for such interaction (Shoemaker, 1995). Viewing scenarios as stories is frequently mentioned within academia (Shoemaker, 1995; Lindgren & Bandhold, 2003; Ramirez et al., 2017; Enzmann et al., 2011; Coates, 2016; Chermack et al., 2001) and the "story"-characteristic is important as it separates scenario planning from traditional forecasting.

3.1.2 Why should scenario planning be used?

Uncertainties are becoming more prominent for the participants within today's business environment and industry actors are increasingly faced with the challenge to become responsive to changes (Chermack et al., 2001). Increasing levels of complexity in combination with new uncertainties and unfamiliarities are creating new challenges for industry actors in order to find the right strategic response. Shoemaker (1995) present several different criteria that might impact the choice of applying scenario planning to a situation or an organizational problem, some of these are: scenario planning might be a valuable tool when uncertainty within an industry is relatively high and the possibilities for managers or decision makers to adapt and make fast decisions are quite low, scenario planning might be a valuable tool when an organization or an industry have had a shaky past, meaning that they might have had events of devastating surprises and scenario planning might be a valuable tool when an industry is already in a state of major change, or is anticipated to go through a period of major change.

3.1.3 Pitfalls of Scenario planning

There are also some limitations to using scenario planning as a research method. Schoemaker (1995) argues that one of the main challenges of conducting a scenario planning analysis is trying to resist the inherent biases that such processes entails. When looking for patterns, which is done in scenario planning processes, we tend to either look for proof that confirms our theories or beliefs, or overlooking proof that disconfirms them (Schoemaker, 1995). Another limit to the method is assuming that there are connections and correlations between factors or trends that are not in fact evident (Schoemaker, 1995). Lindgren & Bandhold (2003) presents additional pitfalls to scenario planning, some examples of these include having an unclear purpose about the whole process, having a too short of a time frame or too long of a time frame, analyzing too many trends or too narrow trends among others. Furthermore, they argue the importance of supporting the chosen trends with evidence and not constructing too general scenarios.

3.2 Scenario planning frameworks

3.2.1 Schoemaker- 10 steps to scenario planning

One of the more quoted scenario planning frameworks within academia is the one provided by Shoemaker (1995). Unlike some of the other frameworks within the field of scenario planning research, Schoemaker (1995) presents a clear and constructive model of conducting a scenario planning analysis, presenting all the different steps that needs to be taken and the related challenges of such. The 10-step framework (Schoemaker, 1995) is described below:

Step 1 Define the scope: The first step is about limiting the study in terms of time frame and dimensions that are going to be included, such as technologies or markets. The time frame is very important as it majorly affects the different scenarios, the chosen time frame can depend on the rate of technological change within a certain industry, the length of product life cycles and so on. One should also use this step in order to limit what kind of knowledge is relevant to the study and identify previous changes within the industry which have been a source of past uncertainty.

Step 2 Identify the major stakeholders: It is very important to identify the parties or actors that will potentially be affected by the changes or issues at hand, and also the actors that have the power to impact the future within the industry. The different stakeholders should be mapped out by describing their potential impact, their positions within the industry, the level of power they can exert etc. It is also important to identify how the different characteristics have been changed, and how they are prospected to change over time.

Step 3 Identify the basic trend**s**: The third step in the scenario planning process is to identify the major basic trends evident in the industry. These are in regard to technological development, legal trends or economic changes among others. One needs to connect these basic trends to the scope set in the first step and determine which are likely to affect them. One should explain the trends and elaborate on the potential influence they might have.

Step 4 Identify Key uncertainties: The fourth step includes the process of identifying the uncertainties connected to the issues that are being examined, most appropriately by identifying the uncertainties of different events and try to understand how the different outcomes might impact the final result. The uncertainties that have been identified might also be examined in terms of internal relationships, how they might correlate and if all combinations are actually feasible.

Step 5 Construct initial scenario themes: After conducting steps 1-4, the basic trends and uncertainties have been identified. Once these are in place, one should separate the different dimensions into positive and negative impact relative to current strategy. One can also combine different uncertainties and display them in an illustrative diagram.

Step 6 Check scenarios for consistency and plausibility: As the scenario themes are highly simplified and do not yet represent reality of some sort, they need to be put into a context and be checked for internal consistency. One first need to check if the trends that have been identified are relevant for the time frame chosen in step one of the scenario planning process. Secondly, one should check the scenarios in order to ensure that they go together, i.e. that their outcomes of uncertainty are consistent with one another. Lastly, one should ensure that the identified stakeholders are actually in a position they would like to change and that the impacts are long-term and so on change into a different scenario.

Step 7 Develop learning scenarios: Once the simplified scenario versions have been created and controlled for consistency and plausibility, emerging themes should be identified and made sure to actually be relevant based on plausibility. The scenarios that are sorted out as relevant, plausible and consistent should be organized according to their potential outcome and trends that have been considered to impact them.

Step 8 Identify research needs: Step 8 works as a control mechanism for which information search might be expanded and further dimensions explored. Further research can regard technologies that expand basic knowledge regarding an industry.

Step 9 Develop quantitative models: The additional research conducted in step 8 are used in order to once again check the scenarios for consistencies and plausibilities. Some of the scenarios might also need quantitative analysis in terms of consequences or internal relationships.

Step 10 Evolve toward decision scenarios: The learning scenarios that have been constructed should be used in order to assess if they capture the issues for a specific company or a specific industry. Check for quality in terms of the scenarios' relevance to address concerns of the users, having high levels of internal consistency (as described in other steps), describing relatively different futures as well as describing long-term change.

3.2.2 Schwenker & Wulf- Scenario-based strategic planning

Schwenker & Wulf (2013) presents a scenario planning approach similar to traditional frameworks such as the previously mentioned presented by Schoemaker (1995), however, their approach is somewhat altered in order to fit shorter scenario planning time frames. The approach consists of six steps based on the traditional scenario planning methods; however, the steps are somewhat modified and contains specific models that should be applied in each step (Wulf et al., 2013). Wulf et al. (2013) calls this framework "Scenario-based strategic planning":

Step 1 Definition of scope: In the first step one must define the scope of the project, and in order to do this, one should apply what Wulf et al. (2013) calls a *framing checklist*. A framing checklist is based on the answers to five questions concerning what level the analysis will have in strategic measures, which stakeholders are to be involved, the level of engagement from top levels within an organization and which members will actually be active in the process, as well as the time horizon for which the process will cover. After this stage, there needs to be a clear process goal present (Wulf et al., 2013).

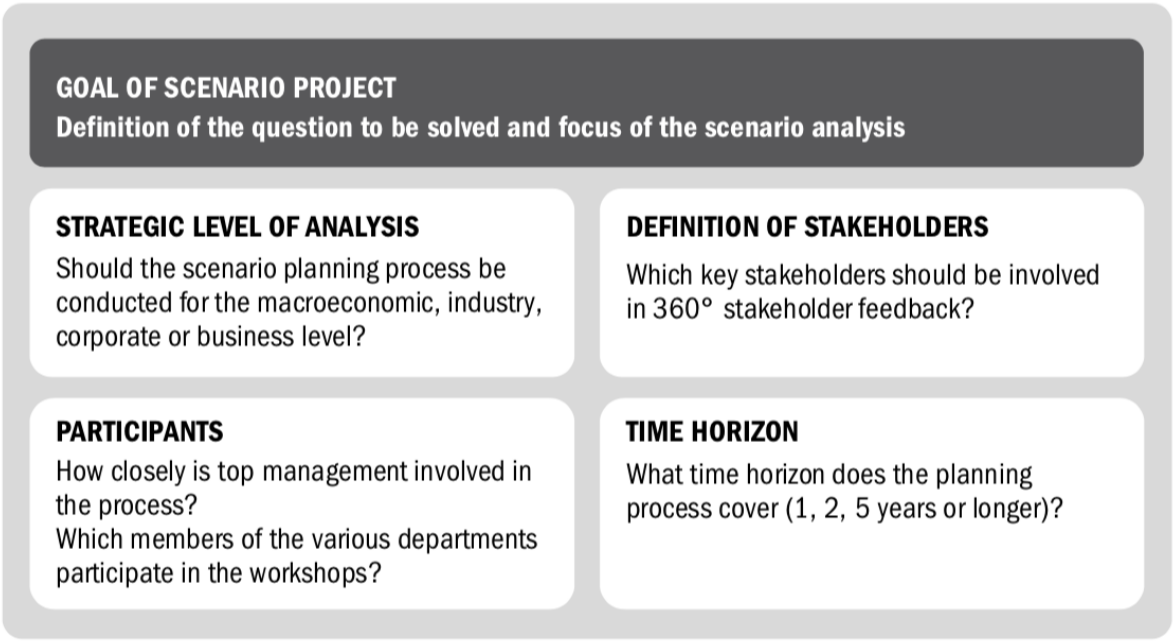

Figure 3: The framing checklist gathered from Wulf et al (2013)

Step 2 Perception analysis: The framework applied in step 2, a step intended to receive thoughts regarding potential changes within an industry from internal and external stakeholders, is what Wulf et al., (2013) calls *360° stakeholder feedback*. This entails receiving feedback on potential influence factors that might impact the industry which can then be evaluated in terms of uncertainties. Questionnaires can be used in a first step to locate the major factors that are identified by the stakeholders and then a new questionnaire with the chosen factors which are rated by the stakeholders in the order of their potential impact on performance as well as level of uncertainty. Having different stakeholders with different viewpoints might enable a wider analysis where potential blind spots and weak signals can be identified (Wulf et al., 2013).

Step 3 Trend and uncertainty analysis: the next step, step 3, is intended to use the development factors that have been identified in step 2 by sorting them into two scenario dimensions. To do this, one should apply a framework that Wulf et al. (2013) presents as an *impact/uncertainty grid*. The different factors are placed in a matrix according to their level of uncertainty and the level of their potential impact. The factors that have high levels of uncertainty and a strong potential impact are called critical factors, these lie as the foundation for the uncertainties (Wulf et al., 2013). Furthermore, the factors that have high levels of impact and low levels of uncertainties lies as the foundation for the trends (ibid).

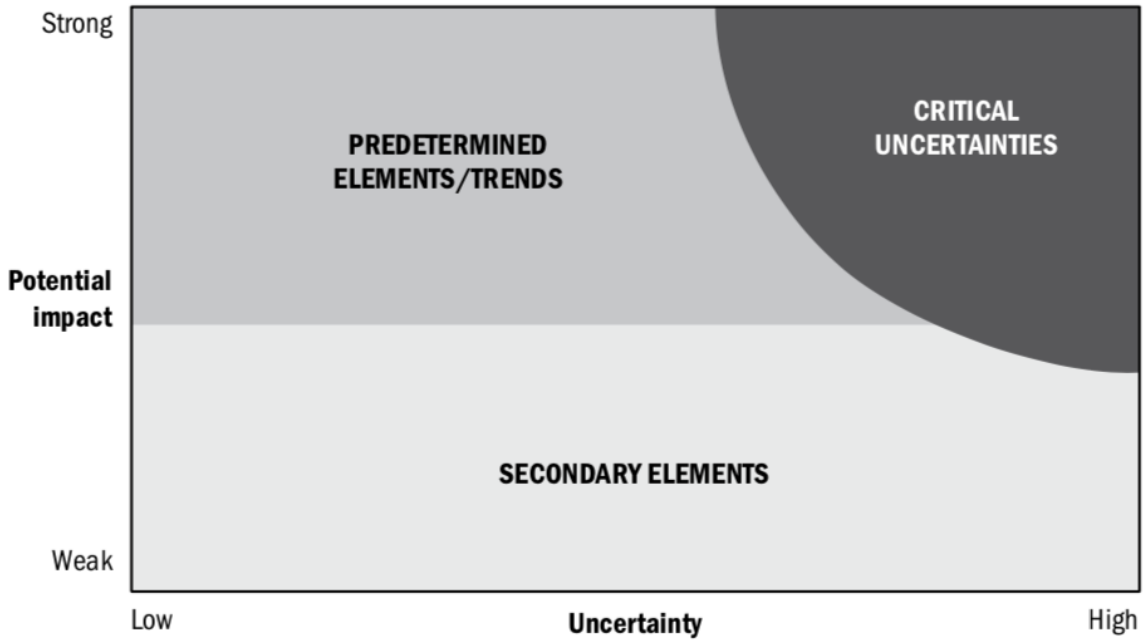

Figure 4: The impact/uncertainty grid gathered from Wulf et al. (2013).

Step 4 Scenario building: By using a *scenario matrix*, one can construct the scenarios. The two scenario dimensions from step 3 are applied in this framework by being divided into two opposing scenarios resulting in four different extreme scenarios displayed in four quadrants. The four main scenarios are named and details regarding them are added before an influence diagram is created, which is a diagram that illustrates cause-and-effect relationships for the trend and critical uncertainties previously identified. After this, storylines for each of the different scenarios are created by changing the different relationships that have been displayed in the influence diagram.

Step 5 Strategy definition: As the four different scenarios with their respective storylines have been constructed, their different directions functions as possible strategic directions (Wulf et al., 2013). As they display concrete futures, concrete actions can be formed. The framework applied in step 5 is called *strategy manual* which basically contains strategic actions needed for each of the four scenarios and then identify the common strategic actions (Wulf et al., 2013). The strategic actions that are common for all four scenarios are used as a core strategy, and the rest of the actions that are not common for all scenarios can be incorporated as strategic responses that will act as a complement to the core strategy.

Step 6 Monitoring: After finding suitable strategic responses or actions in step 5, this step is aimed at implementing the strategic actions. In this step, a *scenario cockpit* is used in order to understand industry development and locate needed changes in the strategy (Wulf et al., 2013). The scenario cockpit illustrates changes within the industry, and depending on these changes, enables further insights into what strategic actions that actually needs to be implemented.

3.2.3 Lindgren & Bandhold- TAIDA ™ framework

According to Lindgren & Bandhold (2003), TAIDA ™ is a well-used scenario planning method that have been used in both practise as well as academia, but also in other project characters. The authors present a thorough description of how such a method can be applied in a scenario planning process:

TRACKING: The tracking phase is aimed at identifying and describing environmental changes that might impact the central question. When going into the tracking phase, one must have some prerequisites determined; time horizon and setting the boundaries of the central question that will be answered through the scenario planning process. When the prerequisites are in place, a clear purpose is formed, and the investigation of the future is initiated. This phase is about identifying important trends or patterns of change, as well as uncertainties.

ANALYSING: After having identified a number of different trends from the previous step, one needs to analyze inherent patterns between the different trends and how they relate to each other. The analyzing stage is hence about identifying what the drivers are for each of the selected trends and what the potential impact will be from such drivers when the trends might go in different directions. Similar to Wulf et al. (2013), the authors suggest identifying the two critical driving uncertainties that are crossed together in a matrix which will create four different quadrants of scenarios. The scenarios need a thorough narrative described in order to visualize a storyline of the potential future happenings. Lindgren & Bandhold (2003) further suggests creating a table where the descriptions of the narratives for the different scenarios are displayed and more easily compared.

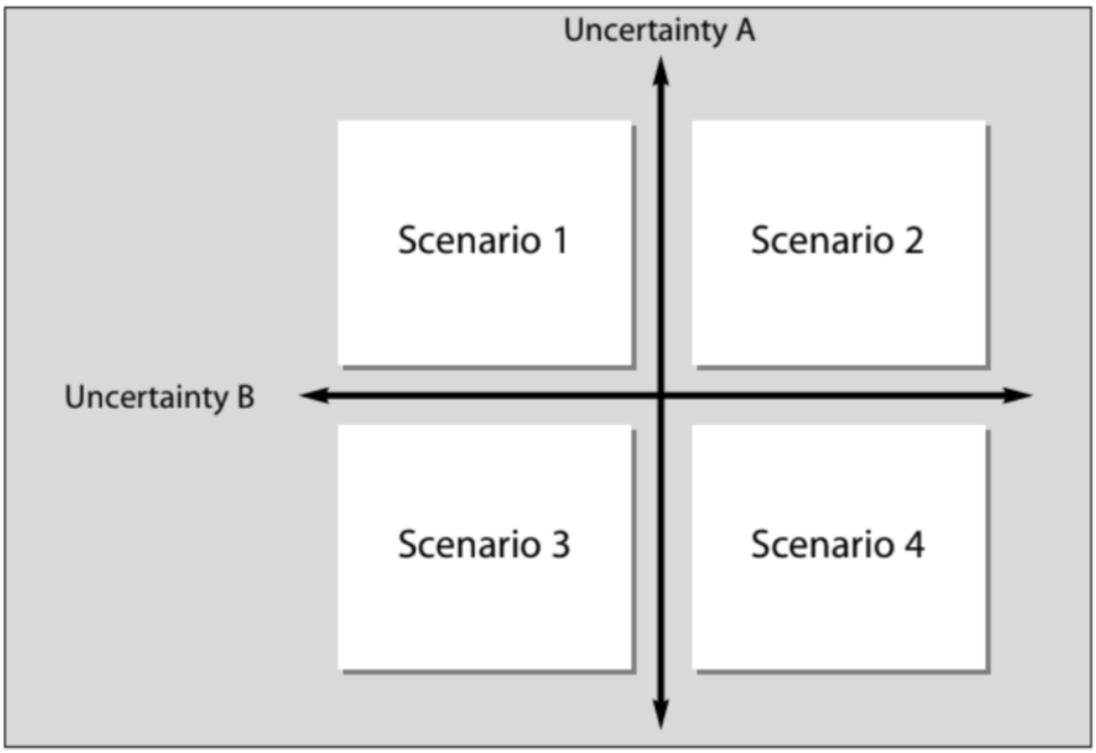

Figure 5: The Scenario Matrix gathered from Lindgren & Bandhold (2003)

IMAGING: The imaging phase contains setting clear goals for the future and describing future visions in order to create a foundation for strategic actions. Lindgren & Bandhold (2003) mentions creating a BHAG, an over-exaggerated goal described in a short sentence. This headline then sets the frame for a vision description that can be used for further strategic actions.

DECIDING: This phase contains summarizing what have been done so far and putting it all into context. As the environmental trends and anticipated changes are identified and analyzed and a clear vision is in place, decisions on further directions are needed. Lindgren & Bandhold (2003) suggests creating a consequence tree for representing a whole system of driving forces, the identified trends and how all of them might have a potential future impact. The driving forces are illustrated as the root of the tree, the trends as the stem of the tree and the different consequences from such are illustrated as the branches.

ACTING: After deciding on which strategic actions are needed and should be implemented, one should put the decisions into actions by actually implementing what has been decided upon. The acting stage also entails following up on the scenarios; monitoring how the environmental changes actually unfolds and continuing to scan the environment for new or anticipated changes (Lindgren & Bandhold, 2003).

3.3 Applied scenario planning framework

A framework has been shaped in order to more appropriately suit this study, with elements gathered from all of the three main scenario methods presented above. Steps including activities of implementation (such as step 8-10 presented by Shoemaker (1995)) will not be used for the sake of this thesis as they partly are too focused on specific companies as well as too focused on actions that are taken after the construction of the scenarios. This study will only focus on constructing the scenarios and not apply them to a specific company. A summary of the applied scenario planning framework is presented in Figure 6.

Figure 6: The applied scenario planning framework

Step 1 Defining the scope: As described in the theoretical framework, defining the scope entails setting the boundaries for the research process (Schoemaker, 1995; Wulf et al., 2013). In the first step, the authors set a clear goal of the scenario planning processes by stating the research question. Furthermore, limitations were set in terms of level of analysis and time horizon. These limitations were based on both the literature as well as the initial meeting with the thesis guiding company that inspired the thesis focus. Furthermore, major stakeholders and process participants were identified in order to make sure that a stakeholder analysis could be conducted. These boundaries were also created through initial discussions with the line agent

company, as well as practise within scenario planning methods. These dimensions are illustrated in a framing checklist (Wulf et al., 2013).

Step 2 Perception analysis: In the second step in the scenario planning process, Wulf et al. (2013) argues that one should conduct a 360° stakeholder feedback by sending out surveys to stakeholders in order to identify future developments within the industry. For this thesis, this step has been altered in order to align with the time horizon. Instead of sending out surveys, the literature review contributed with pre-identified development factors for the industry as well as the technology. These were gathered in order to create a greater understanding for the subject as well as enable identification of previous research within the area. Due to this, the first step of the stakeholder feedback is represented by the literature review investigation. The secondary data used from the literature review is both used to create a foundational understanding of the industry and the technology but also to cover blind spots (Wulf et al. 2013). Furthermore, the first step of the interview with general discussion acted as the foundation for different development factors used in the analysis. During the discussions, the interviewees mentioned development concepts or patterns within the maritime shipping industry, blockchain or a combination of both, which functioned as development factors in this step. All development factors that have been mentioned by the interviewees have been used in the second step of the process, and they are presented in section five of this report. The authors wanted to include all development factors, not only the ones relevant for the scope of this thesis, in this step as it was important to withhold a high level of objectivity at this stage. Since the perception analysis is aimed at finding blind spots or weak signals within the literature, the authors did not want to exclude any factors at this early stage.

Step 3 Identify trends and uncertainties: As already mentioned, development factors were identified in step 2. However, all of these were not adequately relevant for them to be considered major trends and uncertainties. In order for the development factors to be considered a trend or uncertainty, some criteria had to be met. Firstly, the development factor had to be mentioned by five interviewees. Secondly, it had to be relevant within the chosen time frame of five years. Thirdly, it should be relevant according to the impact/uncertainty grid (Wulf et al., 2013). The second part of the interview consisted of more focused discussions where the mentioned development factors within the technology and the industry were viewed more thoroughly in terms of the level of impact on the industry and the level of uncertainty in their outcome. These discussion lies as the foundation for the placements of the different developments factors on the impact/uncertainty grid presented in the analysis section of this thesis.

Step 4 Scenario building: The scenario planning process is initiated by conducting a correlation analysis, purposed to identify inconsistencies in the interrelationships between the uncertainties identified in the previous step. This in order to ensure that the quality of the results and uncertainties is high before actually initiating the scenario creation process. As Shoemaker (1995) argues, one common pitfall within scenario planning is that the researchers apply correlations when they are not evident, and the authors of this report wants to mitigate that by conducting a correlation analysis. The correlations between the uncertainties are partly based

on discussions with the interviewees where they have explained some of the cause-and-effect relationships, but also the logical reasoning for relationships. Furthermore, the two most critical and driving uncertainties identified functioned as the basis for four opposing scenarios representing potential responses to the uncertainties. Two critical uncertainties used for the four scenarios have been selected based on how frequently they were mentioned during the interview discussions, the considered they might have on the selected industry as well as and the level of uncertainty in future outcome. These are presented in a scenario matrix (Lindgren & Bandhold, 2003) in section 6.4.

Step 5 Checking for plausibility: In order to check for plausibility, influence diagrams were created for the four scenarios where potential trends and relationships were displayed. Two tests were run in order to ensure plausibility in the scenarios. These tests were based on the questions presented by Shoemaker (1995): Are the constructed scenarios credible for the chosen time frame? Are the scenarios and the uncertainties correlating in a correct way? The last test that Shoemaker (1995) presents regarding stakeholders are not applied as it mainly concerns macro perspectives which is not the case in this thesis.

Step 6 Scenario storylines: In the last step of the scenario planning process, thorough and detailed storylines (also called learning scenarios by Shoemaker (1995)) were constructed for each of the scenarios. Different storylines were constructed in reflecting different relationships of the critical uncertainties and major trends. The storylines are considered important as they function as visualization tools for the future development (Lindgren & Bandhold, 2003). Titles to the different scenarios were also added as Shoemaker (1995) argues that titles are valuable in order to make the scenarios easier to follow and understand content wise.

4. Methodology

4.1 Introduction

In the methodology section, decisions and actions taken throughout the thesis are described and motivated for. As the thesis is based on a scenario planning analysis, some of the procedure steps have been affected by such a research approach. The methodological choices are further described in the sections below.

4.2 Research strategy

The research strategy used in the thesis is of a qualitative character as the authors argue that only an in-depth analysis containing many different dimensions and views on both technology and future development will provide a desired level of quality when completed. The authors further argue that a qualitative research strategy provides a higher level of flexibility in the study, an aspect which is considered valuable due to the iterative character of scenario planning methods. This argumentation is aligned with the one provided by Bryman & Bell (2015) who mentions that qualitative research strategies are somewhat more flexible and provides a deeper and more thorough analysis of a study subject. Furthermore, the research strategy used in order to answer the research question is of an inductive character (Bryman & Bell, 2008; Eriksson & Kovalainen, 2008), meaning that an already established hypothesis has not been tested but rather a new hypothesis has been intended to grow through the research process and in the end creating different scenarios for the shipping industry and its technological future. The authors also argue that the inductive character is valuable in relation to the nature of the research question, as the question is explorative rather than testing, hopefully in the end leading to useful and relevant industry insights.

4.3 Research design

As mentioned in the first chapter of this report, the purpose of this study is to answer the question of what role blockchain technology might have within the maritime shipping industry in five years. When aiming to answer this question tremendous amounts of data can potentially be gathered. When using a traditional research design, such as a case study design, and still having the set research question, it can lead to an undesired wideness in results. Because of this, it may not contribute with valuable industry insights but rather with easily anticipated points of conclusions about industry development. Hence, the authors chose to base the research design on conducting a Scenario planning analysis due to the fact that such methods simplify the sorting of gathered data into a limited number of scenarios (Schoemaker, 1995) as well as functions as a passage through which ideas can be filtered according to relevance or future anticipations (Lindgren & Bandhold, 2003).

Furthermore, the authors argue that applying scenario planning as the research design can provide valuable industry insights and help organizations in their strategic thinking as well as actions in being dynamic and flexible. Scenario planning is also useful for investigating industries going through change and industries that are experiencing a high level or uncertainty (Shoemaker, 1995; Lindgren & Bandhold, 2003) which are all factors characterizing the maritime shipping industry at this point in time. Different from contingency theory, the method

explores a number of uncertainties and the effect they have collectively on a certain outcome (Shoemaker, 1995). The authors truly value this as the answer to the research question calls for a combination of different uncertainties affecting the industry and the business environment, rather than analyzing one uncertainty at a time.

Bryman & Bell (2015) discusses different dimensions of a research design and mentions the time aspect as one of the most prominent. A research study can be conducted in different time dimensions, at one point in time or during a longer time period over such as in longitudinal studies. When executing the thesis through conducting a scenario planning analysis, the actual study is conducted at one point in time due to the time restriction as well as the purpose of the research. However, the results obtained at this point in time is used in order to create plausible future behaviors or changes five years from now. The time aspect of the study hence becomes more complex than for perhaps a traditional qualitative study conducted at one point in time with the purpose of being used to explain a certain phenomenon at that certain point in time.

4.4 Research method

The data collected throughout this research process and the way that it is processed, understood and structured, is described in this section. The data collection is an iterative process where the authors have revised the collected material throughout the entire timeline of the process, making sure that all collected data is relevant for the research question as well as for being processed and presented in correct ways. The data collection phase was initiated by collecting data from secondary sources, full process described in the section below. This secondary data has been used as the basis for the primary data collection, where the authors chose to conduct qualitative interviews (Bryman & Bell, 2015; Eriksson & Kovalainen, 2008) in order to retrieve in-depth conversations and additional dimensions considered as impossible with other techniques, such as surveys. However, the secondary data solely functioned as guidelines during the interviews, and when important or intriguing dimensions appeared when gathering the empirical data (described in section 3.4.2), the authors iteratively revised the secondary data in order to ensure that the data collected covered the desired spectrum. Some of the secondary data also functioned as the theoretical framework.

4.4.1 Secondary data

As the research method used in this report is scenario planning analysis, the secondary data that has been gathered functions as two different functions, both as a theoretical framework reflecting research and frameworks behind scenario planning methodologies as well as a foundation for the literature review later on used in the interviews. Some of the gathered secondary data is therefore collected to represent characteristics of the maritime shipping industry and the different ways of implementing blockchain technology in the shipping industry in order to investigate the potential in doing so. The secondary data represents two important theoretical functions in the study, and as already mentioned, the iterative nature of the information used in the empirical discussion enables the research process to be more flexible and benefits the authors in a way of reaching new insights throughout the data collection process.

In order to simplify the collection of secondary data and to display full transparency in the data collection process, some criteria were set prior to the data search. These criteria functioned as the frames that would outline the theoretical framework to ensure that the selected material was coherent in terms of relevance, reliability, trustworthiness and alignment with the subject that was to be researched. As already explained, the secondary data fulfils two somewhat differing purposes and the inclusion and exclusion criteria also differ between the two dimensions. This due to the fact that the material needs to be of different character as it has different functions for the study. The inclusion criteria are displayed in Table 2 and the exclusion criteria are displayed in Table 3.

Inclusion criteria for theoretical framework	**Inclusion criteria for literature review**
Academic articles as a main source of data	Management consultancy reports from recognized firms
Academic articles published later than 1990	Governmental agency reports
Academic articles that are peer reviewed	Reports produced later than 2008
Academic articles describing different approaches to scenario planning	Academic articles generally investigating blockchain in terms of the potential applications (permissioned or permissionless)

Table 2: Inclusion criteria for the collected secondary data

Exclusion criteria for theoretical framework	**Exclusion criteria for literature review**
Data from sources that does not originate from a scientific stance	Management consultancy reports which are clearly skewed to favour of a specific firm or organization
Academic articles published before 1990	Governmental reports aimed at investigating Blockchain in a B2C context
Academic articles that are not finished, correctly published or peer reviewed	Reports produced earlier than 2008
Academic articles presenting scenario planning methods that are not recognized within the research field	Reports specifically investigating permissionless Blockchain

Table 3: Exclusion criteria for the collected secondary data

When collecting the secondary data, several different databases has been used. A few examples of the databases used are the library of Gothenburg's own search function "Supersök", Sciencedirect as well as Oxford Handbook Online. For the theoretical framework, the majority of the material gathered consists of articles from academic journals or theories from academic books. The secondary data used in the literature review is more based on consultancy reports and reports from several different agencies. The secondary data gathered from such sources are compared to each other in order to identify similarities or patterns consistent between them in order to locate major trends later on used in the empirical discussion.

4.4.2 Primary data

The method for collecting the primary data for this study are conducting semi-structured interviews. Qualitative interviews are by the authors viewed as the most appropriate in order to answer the stated research question, this due to the in-depth analysis and several dimensions

that can be covered from such data collection. This argumentation is similar to the discussion provided by Bryman & Bell (2015) who mentions that qualitative interviews is a suitable method for identifying and retrieving in-depth conversations and richer analysis results. The authors further argue that conducting interviews enables better interpretation of additional dimensions such as body language, tone of voice and so on which helps the authors to interpret the results in a more high-quality manner relative to other methods. Semi-structured interviews are considered the most appropriate structure for conducting the interviews as it provides a higher degree of flexibility to the process (Bryman & Bell, 2015; Eriksson & Kovalainen, 2008), an aspect that the authors truly value as it enables the iterative research approach desired for the process. It allows the authors to go back and forth between the secondary and primary data when finding new and valuable dimensions, but at the same time allowing some structure making sure that the conversation stays within the frames of relevant areas.

Interview procedures

For the gathering of the primary data for this thesis, ten interviews have been conducted. All of the interviews were initiated approximately one week before the actual interview date by the authors sending out interview information (displayed in Appendix 2), simply to prepare the interviewee about the topics that were going to be addressed and provide the interviewee with the chance to ask questions. The semi-structured interviews have been conducted face-to-face as often as possible, however, for three of the interviews the geographical differences have been an issue, hence three of the interviews were conducted via Skype. An interview guide was used during the procedures (the interview guide is illustrated in Appendix 1) and the time was divided into two main parts. The first part of the interview consisted of general discussions based on the studied topic. The second part consisted of a more focused discussion regarding trends and the level of impact and uncertainty of the respective trends. This interview procedure was chosen as it reflects the different steps in the customized scenario planning method used for this thesis. The full scenario planning process is more thoroughly described in the last part of the methodology section. All of the interviews have been recorded after consent to do so and the transcriptions and quotations have been approved by the interviewees. A summary of the interview procedures is displayed in Table 4.

Interviewee	**Date**	**Character**	**Length**
Person A (PA)	2019-03-19	Face to face	50 min
Person B (PB)	2019-03-20	Skype	30 min
Person C (PC)	2019-03-21	Face to face	60 min
Person D (PD)	2019-03-27	Skype	40 min
Person E (PE)	2019-03-28	Face to face	50 min
Person F (PF)	2019-03-29	Face to face	45 min
Person G (PG)	2019-04-01	Skype	40 min
Person H (PH)	2019-04-01	Face to face	60 min
Person I (PI)	2019-04-03	Face to face	90 min
Person J (PJ)	2019-04-08	Face to face	50 min

Table 4: Summary of the interview procedures

As already mentioned, the interviewers used an interview guide. In order to enable a certain level of flexibility but at the same time make the results for the collected empirical data comparable, an interview guide (Bryman & Bell, 2015) was considered important. An interview guide is a valuable tool that can be used not only in identifying the full research area that needs to be covered in the interviews but also in making sure that the interview discussions stay relevant to the chosen topic. The questions illustrated in the interview guide are based on the secondary data used for the empirical discussion and open questions where found important by the authors in order to reach a desired level of flexibility and the collection of as wide amount of information as possible.

Interviewees

The interviewees have been selected based on two criteria. Firstly, the interviewees were chosen based on their connection to either blockchain, the industry or both. This was considered important as the different perspectives functions as the basis for the created scenarios. Secondly, they had to be knowledgeable within their competence area and have experience connected to their field. Naturally, as the discussions and insights gathered from the interviews lies as the foundation for the final analysis in this thesis, the interviewees competence has been valued highly. As there are many different stakeholders involved in maritime shipping value chains, different perspectives to the potential application of blockchain within the industry are evident. As scenario planning includes perspectives and insights from different stakeholders (Shoemaker, 1995; Lindgren & Bandhold, 2003; Wulf et al., 2013), interviewees representing different perspectives were selected for the thesis. Even though the topics somewhat overlaps, one can say that the interviewees can be divided into three main categories depending on their competence area: blockchain, maritime shipping industry and a combination of the two.

Competence area	Respondent	Title	Company
Blockchain	Person B (PB)	Senior lecturer	University of Gothenburg
	Person D (PD)	Associate senior lecturer	University of Gothenburg
Blockchain & maritime shipping	Person J (PJ)	Project leader within intermodal transports and seafreight	CLOSER
	Person E (PE)	Business intelligence manager	Tank shipping company
	Person F (PF)	Professor of maritime transport management and logistics	University of Gothenburg
	Person G (PG)	PhD/researcher	Department of Maritime Operations at USN
Maritime shipping	Person A (PA)	Operations manager	Line agent company
	Person I (PI)	IT manager	Freightman AB
	Person C (PC)	Senior manager market intelligence	Port of Gothenburg
	Person H (PH)	Security and environment advisor	Svensk Sjöfart

Table 5: Summary of the interview respondents

Pilot interview

To ensure that the interview guide obtains a high level of quality, it was initially tested in two pilot interviews before the actual the primary data collection started. This is an aspect encouraged by Bryman & Bell (2015) as it increases the quality of the interview guide due to the possibility to alter potential defects and making sure that the respondents are interpreting the questions in similar ways, thus improving the internal reliability of the results (Bryman & Bell, 2015). During the pilot interviews the authors received important feedback and suggestions for alterations which improves the structure of the questions and the overall quality. The pilot interview was conducted by interviewing two different people, one with prior knowledge of blockchain and one with prior knowledge regarding the industry. As a result, a smaller workshop was removed from the interview protocol in part two as both interviewees misunderstood the task and found it confusing.

4.5 Data analysis

There are several different ways of processing and structuring data (Bryman & Bell, 2015). How the data analysis process is shaped and how the activities are performed ultimately affect the outcome of the study. The first step in a data analysis process is the breakdown of raw data (Bryman & Bell, 2015) which for this study includes breaking down both the secondary data used for both the empirical discussion and the theoretical framework as well as the primary data collected from the qualitative interviews. As already mentioned, the secondary data was continually revised and sorted according to relevance, as the study has an iterative approach to it. Hence, the secondary data has been continually broken down and processed during the research process. The primary raw data received from the interviews was initially processed by listening to the recordings and checking the material for obvious flaws or misunderstandings in order to increase the quality of the data. The interviews were partially transcribed and sent to the interviewees for approval, however, they are not a part of the thesis report due to the fact that the relevant material is presented in the empirical discussion.

According to McLellan, MacQueen and Neidig (2003), transcription of an interview is very time consuming and not always needed. A partial transcription could rather be used as long as the research question is the main driver of the analysis. Since the time frame has been fairly narrow, and relatively many interviews have been conducted, the authors argue that a partial transcription is more appropriate for this study. After the partial transcription, the data is coded into emerging patterns, this to be able to detect themes between the different interviews and find common denominators important for the scenario construction. Hence, a thematic analysis has been done (Bryman & Bell, 2015) in order to identify the important topics or patterns of discussion that are crucial for the construction of the future scenarios. The themes are constructed by identifying, analyzing and presenting the patterns within the data (Braun & Clarke, 2006), this will enable a higher degree of data structure and thus increase the level of comparability in the results, an aspect that can be somewhat challenging in qualitative studies (Bryman & Bell, 2015). As this thesis is based on a scenario planning analysis, the data has been coded into developing factors (presented in section 5.2-5.4) and the themes are based on the trends (presented in section 6.3).

4.6 Research quality

The quality of the data used and processed in this thesis will be evaluated through two different concepts connected to research quality; validity and reliability. Bryman and Bell (2015) presents different ways of how the level of quality in qualitative research studies can be measured and which criteria can potentially be used in such evaluations, such as authenticity and trustworthiness. For this research process, reliability and validity are used. These are two widely accepted measurements of research quality (Bryman & Bell, 2015) and the authors fully argue that a discussion and motivation of these measurements will provide both valuable insights for the reader and a desired level of transparency. Validity and reliability are two concepts closely connected to objectivity, one of the most crucial aspects in a research process (Bryman & Bell, 2015) which further motivates the authors to take the possible measures to ensure that the objectivity is as high as possible during the research process.

4.6.1 Reliability

High quality in terms of high levels of reliability in qualitative studies can sometimes be trickier to achieve in comparison to quantitative studies, as the reliability concept is mainly based on how replicable the research is and how consistent the results are (Bryman & Bell, 2015). With this in mind, the authors have aimed at making the research process as replicable and consistent as possible whilst being aware of the limitations. In addition to this, although the semi-structure of the interviews provides less replicability of the research, the interview guide provides somewhat higher levels of replicability as it provides structure and making sure that all interviews were conducted regarded the same area of subject. In terms of replicability and consistency, one should also mention the time dimension of this study as it greatly impacts the final result. The scenario analysis is conducted in a five-year time frame, and as technologies rapidly evolve, conducting the same study might provide widely differing results if conducted in a few years. However, this is one of the valuable characteristics of scenario planning; providing scenarios of the future based on the current trends and situations.

4.6.2 Validity

Validity can be both internal and external (Bryman & Bell, 2015). Qualitative studies can have internal validity in terms of how credible the research process is (Bryman & Bell, 2015), for example in terms of research ethics and following the general practise of conducting qualitative research. The authors have respected research ethics dimensions, such as being transparent and truthful, as well as presenting the interview objects in a truthful way. In addition to this, the authors have followed standard procedures for conducting research which are recognized within academia. The exclusion- and inclusion criteria in combination with the delimitations have also ensured the internal validity as they have set the needed frames for the study. External validity often regards to what degree a study can be generalized, i.e. to what extent the results and conclusion can be applied to other contexts or other situations. Bryman & Bell (2015) argues that qualitative studies are harder to generalize as the collected data has a narrower nature and usually a smaller data sample, making the results harder to generalize to other social contexts. However, these characteristics are valued by the authors as it is the in-depth analysis and several-dimension conversations that provides the study with a desired level of quality. Furthermore, the different steps of the scenario planning method used in this thesis are

thoroughly described throughout the report where both course of action as well as motivations and criteria applied in such are presented continuously. This transparency is viewed as highly important in order to improve the validity of the results.

5. Empirical findings

5.1 Introduction

In order to identify the key concepts in the future role of blockchain within the maritime shipping industry, an empirical discussion was conducted of which result is presented in this section of the thesis. From the gathered secondary data presented in section two, some of the major development factors in all three of the below categories were identified and structured before the gathering of the primary data was initiated. In order to clarify these pre-identified factors, these have been marked with an "*" in the table 5, 6 and 7 which are aimed to map out the different development factors and locate if they are mentioned during the interviews. The development factors that are not marked have been identified during the conducted interviews. The mentioned development factors are marked with "M".

Empirical findings from initial meeting with guiding company

From discussions held with the company, some initial findings were identified which have been used as the base for some of the boundaries in the scenario planning process. Firstly, the inspiration company mentions that they have recognized that the maritime shipping industry is going through major changes and the fact that they are highly uncertain regarding how industry development might affect them and the other actors. Secondly, the company mentions that blockchain technology is one of the more interesting dimensions to look into as they have already been intrigued of the subject from becoming aware of industry projects including blockchain. Thirdly, the company representatives argue that the whole industry could potentially be investigated in order to identify the major trends.

5.2 The identified industry development factors

Factors	Pre-identified	PA	PB	PC	PD	PE	PF	PG	PH	PI	PJ
Consolidation	*			M			M	M	M	M	M
Price sensitivity		M		M		M	M	M		M	M
Data protection				M		M	M	M	M	M	
Business relationships	*	M				M	M			M	M
Technology	*	M		M			M	M	M		M
Vessel size				M			M				M
Sustainability	*	M		M			M		M	M	M
Transport volumes	*	M		M			M		M		
Conservatism	*	M		M		M	M	M		M	M

Table 6: Industry development factors

5.2.1 Consolidation

The consolidation trend is mentioned by several interviewees. Both Person C (PC) and Person G (PG) argues that consolidation of actors and higher level of collaboration is evident within the industry, partly due to the price cutting mentality and low margins within the industry. This is also mentioned by Person F (PF) who argues that consolidation within the industry is one of the more prominent patterns.

"A trend within the maritime shipping industry is the concentration to fewer shipowners"
- Person F

The consolidation within the industry is further mentioned by Person H (PH) who argues that there is a new level of collaboration and cooperation within the industry and new types of relationships are forging by different projects. Person I (PI) also mentions consolidation as one of the biggest trends within the industry and that it has come to change how the industry works since the market share has increased for the larger shipping companies.

5.2.2 Price sensitivity

Several of the interviewees mentions price sensitivity within the industry as one of the more prominent characteristics. Person A (PA) argues that the struggle to become profitable is in focus for the majority of actors in the industry. It has become hard to remain profitable on simply delivering the service minimum, nowadays one needs to become more creative in finding solutions. PA further argues that these characteristics somewhat makes it hard for actors working as middle men to defend their role in the value chain. Price sensitivity is also mentioned by Person B (PB) who argues that the industry actors are under high price pressure due to the fact that they are basically selling the same service and Person E (PE) argues that there is a potential to implement some sort of platform with a digitalized broker negotiating freight rates for different actors. Furthermore, the price sensitivity is confirmed by PG and PI who mentions that companies are competing on low margins within the industry and that companies are cost-cutting to a large extent.

5.2.3 Data protection

Both PC and PE mentions that there is general data protection dimension within the industry, where industry actors due to high competition are not willing to share data. PC argues that a lot of the industry actors are basically competing with the same type of service and sharing data with other industry actors are hence not desired. PG mentions that even though there is a cultural barrier and a resistance to change, companies within the industry are going to be forced to share their data on dimensions that does not concerns the core business. She argues that data of vessel space for example could be shared whilst other data is kept private. Data protection is also lifted by PI and PF, where the formed argues that that due to the high competition there will be a great resistance to share their data with others and the latter mentions that industry actors will be forced to share data but only some data.

5.2.4 Business relationships

PA mentions that there is a close customer contact within the value chains, and that human interactions are important. He further argues that he believes that the human contact and strong relationships with other actors will increase in importance. PI agrees with PA regarding the importance of personal contact and he believes that it will not lose its value when new technology is implemented. Rather he believes that new technology will help them develop even stronger relationships. PE argues differently, he also mentions the traditional and strong relationships within the industry but think that the development will go in the opposite way. This is similar to the discussion by PF who also argued that the industry is characterized by strong and friendly relationships but also believes that these strong ties are being loosened up.

5.2.5 Technology

The technological is one of the more frequently discussed development factors during the interviews. PC discusses the technological trend within the industry and mentions that the industry has been, and still is, very traditional but there is an overall desire to progress in technological terms. In addition to this, he argues that digitization will most likely have an impact, but it is still hard to understand in what way and when, he believes that the major players within the industry needs to take the initiative in order for others to follow. This is confirmed by PF who also argues that someone needs to initiate more investments and others will follow.

"The industry is rarely early adopters. Someone has to go first, and we have seen that industry actors are very good at following each other."
- Person F

The technology aspect is also discussed by PA who argues that there is a need for standardization, and that technological solutions such as IT-systems needs to be flexible and able to adapt to new conditions in order to provide true value. PG argues that there is a resistance to invest in technology within the industry but that the major players needs to initiate a technological transition. She further argues that the industry actors right now are lacking in both knowledge and resources in order to move forward.

5.2.6 Vessel size

According to PC, the shipping industry has shown patterns of continuous growth in vessel sizes for many years. He argues that the size of the vessels has kept increasing since the cost per transported unit decreases as the size of the ship increases, creating economies of scale. However, PC also mentions that there is a challenge with this trend and that is for the port to fit the larger ships in the port area which calls for deeper ports and increased volume management as peakes of goods increases. The progression towards even bigger vessels is further mentioned by PF who argues that vessel sizes are increasing as companies want to tie up capacity and increase revenues.

5.2.7 Sustainability

The increasing sustainability concern within the maritime shipping industry is discussed by several interviewees. PA argues that sustainability concerns and new sustainability regulations impact different industry actors in different ways and PC mentions that in the maritime shipping industry, the environmental challenge is definitely there but it is still a fairly environmentally friendly transportation mode. PC further discusses the fact that transportation customers are not willing to pay for sustainability efforts in the industry if there is no regulation due to the enclosed costs. Furthermore, PF mentions an increase in regulation within the industry and argues that there has been an increase in communication between the regulators and other actors within industry in terms of sustainability concerns. This is also confirmed by PH who mentions that sustainability is one of the most prominent impact factors within the industry and that the interest for it is evident both in increased regulations but also a noticeable interest from

companies within the industry. This is creating a higher demand for transparency and visible information within the industry.

5.2.8 Transport volumes

Both PA and PC mentions that there are huge amounts of goods that are being transported within the industry. PA mentions that the volumes that are being transported will continue to increase and that customer requirements for higher quality increases for the transported goods as well. PC confirms that transported volumes within maritime shipping will most likely continue at the same levels if major changes to customer behavior or customer demand also changes. This is also confirmed by PH who mentions that seaborne transportation will most likely increase, and the industry will continue to play a huge role towards a more sustainable transport society.

5.2.9 Conservatism

The conservatism within the industry is mentioned by several interviewees. PA, PC and PE all mentions the traditions and old-fashioned processes within the industry. PA mentions that there is a will to implement new technology and to change, however, not much initiatives are actually implemented. PE further argues that there is a resistance to invest and that this is a major challenge which needs to be overcome.

"A challenge is the conservatism in the industry which creates resistance to invest in new technologies, but I believe that the industry is in transition [[..]] and therefore the willingness will change"
- Person E

However, both PC and PE mentions that they believe that the conservative climate is changing. In addition to this, PF also mentions that the maritime shipping industry is quite traditional and conservative, however, he believes that this aspect is slowly about to fade away. Both PH and PG confirms the conservative dimension of the industry and argues that there is a great potential for innovation and progression but that there is a general lack of resources in order to move forward. PI also confirms that the industry is conservative but believes that for the industry to develop further, the focus needs to be on what the customer wants and also that new technology investments need to start in the right place so that every actor can follow and understand the technology.

5.3 Blockchain development factors

Factors	Pre-identified	PA	PB	PC	PD	PE	PF	PG	PH	PI	PJ
Connectivity		M						M	M		M
Scalability	*		M		M			M	M		
Security	*	M	M		M	M			M		
Business control			M	M	M	M			M		
Value chains	*	M	M		M	M	M				
Blockchain design	*		M	M	M	M		M			
Transparency	*		M	M	M	M	M	M	M	M	M
Hype		M	M		M	M		M		M	M
Competence			M		M	M		M			
Regulation	*		M					M		M	

Table 7: Blockchain development factors

5.3.1 Connectivity

PA mentions the importance of the technology to be adaptable and flexible in its application, this in order to enable new customers to enter the chain and connecting the different parties involved into one flexible system. This will according to PA, in the end, shorten processes. PJ confirms the possibility of blockchain in terms of connecting different parties more efficient platform than other platform technologies.

5.3.2 Scalability

PB confirms that one of the major challenges of blockchain technology that actors are trying to mitigate is scalability. He argues that there is still no consensus regarding potential solutions to scale the technology properly and that in comparison to centralized solutions, it is much harder to use the technology in scale. The scalability problem is also confirmed by PD who argues that there are limitations in scale in regard to technical capability, it can be costly to make changes in the chain and permissionless chains in particular needs a lot of traffic. PF also mentions that many initiatives have been taken in regard to blockchain, however, the scalability is lacking and too few important parties are involved. The issue of scalability is also mentioned by PG who argues that in order for blockchain to work, a steady system needs to be in place and the technology needs to be controlled.

5.3.3 Security

Security is discussed by different interviewees. PB for instance mentions that blockchains is a high-security technology as it is based on data ownership and the ability to trace transactions, i.e. distributed security. He mentions that the argument that permissionless blockchains are not secure is faulty and simply a way for organization to distance themselves from change and not having the courage to invest in new technology. This is also discussed by PD who argues that the technology is hamper resistant which automatically creates security in transactions.

5.3.4 Business control

One of the interviewees mentioning the improved business control that blockchain entails is PB. He argues that blockchain technology will bring an entire new paradigm within business control as centralization of control and operations are no longer needed. PB truly emphasizes that this is what distinguished blockchain from other technologies and argues that the

decentralized control might bring a whole new market coordination behavior. This argumentation is similar to the one held by PD, who argues that decentralized control has the potential to disrupt organizations and their processes, however, the outcome from this is still highly uncertain. He further argues that decentralized control might affect the dynamics in the principal-agent problem which might have great implications for business governance.

5.3.5 Value chains

One of the interviewees mentioning the implementation of blockchain in value chains in PB, mentioning that the technology has been initiated to be implemented in for instance the food industry value chains. However, he further argues that even though there are several different initiatives within many industries, no widespread implementation has been successfully applied. PB mentions that there is right now proof-of-concept, but yet no proof-of-value, meaning that organization and industry actors are hesitant to fully commit to the technology as the true value of such investments have not been established. PC argues that blockchain might impact individual value chains, and not industry-wide patterns.

5.3.6 Blockchain design

The different blockchain designs that have emerged are discussed by PB who argues that only permissionless blockchains are actual blockchains. This due to the fact the he believes that only fully decentralized control and full access is the true definition of the blockchain technology. PB further argues that the emerging designs of permissioned blockchains are simply a way for companies to not fully invest in the changes needed for implementing such technologies and a way to gain market shares. PD discusses somewhat different by accepting the different branches.

"One thing I would like organizations to do is to look at the core concept of the technology and figure out if they should have permissioned or permissionless. [[..]] Making the design decision early in the project rules out all the more interesting design choices they could have done, which in my opinion is permissionless. Since this more often have provided disruptive innovation"
- Person D

Even so, PD still argues that it is the permissionless chains that are the true innovations with disruptive potential, even though they can be hard to implement in some industries. PG also mentions the different design choices within blockchain; however, she argues that there is a potential in both permissioned and permissionless chains. She further argues that the important aspect in this context is the fact that no one should own it, one company should not own the chain and if permissioned chains are used, they should instead be facilitated by a neutral partner.

5.3.7 Transparency

When discussing blockchain technology, PC is one of the interviewees mentioning transparency in business processes. He argues that many actors within the industry are selling the same service, i.e. the competition is very fierce, and that they perhaps value a lack of

transparency in their value chains because of this. In addition to this, PD also mentions the potential of blockchain to provide increased trust and transparency into supply chains, which can potentially lead to novel services. He mentions that tracking assets and sharing that data has true potential to improve transparency within value chains. PF also mentions the transparency aspect as one of the more important sides to blockchain:

"Blockchain and other technologies can be a way for authorities to verify the transparency [[..]] many shipowners are family-owned which means that they do not have the same level of transparency as listed companies"
- Person F

The transparency that blockchain provides is something that PI doesn't believe is only positive since the industry became more open the shipping companies changed their behaviour and started focus more on sales and the price was forced down. To make the industry more transparent it would continue to force down the prices which would generate smaller margins which could make actors resistant toward the technology. A fairly unexplored aspect of the transparency dimension is brought up by PJ, who mentions the vital importance of trusting data. Not trusting data is time consuming and causes bottlenecks, he further mentions that blockchain is a potential solution to this problem.

5.3.8 Hype

Several interviewees mention and confirms that there is an overall hype surrounding blockchain. PB and PD argues similarly by discussing the fact that blockchain has been hyped up in terms of expectations of what the technology can do. PD further argues that the expectations caused from the hype will most likely never be met whilst PB argues that the expectations cannot be met due to the technology not being developed enough. In addition to this, PD argues that managerial problems connected to the technology caused from the hype are evident in the case of blockchain, where the technology has been hyped up to a large extent but the understanding of it is lacking.

"There is a managerial problem related to the hype that is a lot trickier to fix than the technical problem and you have to educated people on the misconceptions which might take longer time than expected."
- Person D

He further mentions that blockchain is not a technology that can be viewed as "pre-packaged" and ready to implement, there are a number of design choices and configurations that needs to be made. PG argues similarly and mentions that the hype of the technology is harmful that the value of the technology needs to be in focus and the requirements for such. PI and PJ express that from an industry perspective, blockchain is mostly used as a buzzword which is surrounded by a lot of hype and there is a difficulty of seeing the true advantages of blockchain.

5.3.9 Competence

PB mentions during the interview that there is an overall lack of right competence within the blockchain context and that it is hard to involve the right people in different projects. This is confirmed by PD who also argues that a lack of competence has been evident over the years, and solutions to this development is not yet evident, probably due to the fact that the technology is still vague. He also mentions that you have to educate people on the misconceptions, and that might take longer time than expected. Furthermore, PG argues that there has been great focus on the business side to blockchain but that there is a general lack of understanding for the technology. She mentions that blockchain has great potential, but it takes effort and resources to the applied correctly. Another key aspect in this area according to PG is that companies need to realize that blockchain cannot replace everything, and that a full system surrounding the technology needs to be in place.

5.3.10 Regulation

During the interviews, the regulating dimension of blockchain was discussed by several of the interviewees, both in terms of the need for regulating the technology but also how current legislation might impact the willingness to use the technology. For instance, PG mentions that regulations will probably occur surrounding blockchain, but that this regulation might be focused on protocol and directed towards the public and cryptocurrencies. Furthermore, PB mentions that recent regulations also affect blockchain, companies tend to not wanting to own data on customers which is a problem for blockchain. PI mentions the new regulations that has affected how the industry manage data, most of all GDPR and is worried how blockchain could impact how the industry needs to manage data. He also mentions that for the industry to implement blockchain there is a need for regulations in terms of ownership.

5.4 Blockchain in the maritime shipping industry context

Factors	Pre-identified	PA	PB	PC	PD	PE	PF	PG	PH	PI	PJ
Documentation	*	M		M	M	M		M	M	M	M
Data analytics	*					M		M	M		
Streamlining operations	*	M		M	M		M				
Smart contracts	*				M	M					
Organizational capability	*	M	M		M	M		M	M	M	M
Technological infrastructure						M	M			M	
Traceability			M		M	M	M	M	M	M	M
Trust				M		M		M	M	M	M

Table 8: Development factors of blockchain within the maritime shipping industry

5.4.1 Documentation

One of the areas that has emerged in terms of how to use blockchain within the industry is documentation. Both PA and PC discusses the fact that the maritime shipping industry is heavily dependent on documentation. This documentation need creates high costs and inefficiency. Both interviewees feel that blockchain could be a solution to provide the documentation in a more efficient way. PA and PC confirms that there is a wave of digitization in the industry but that it is a slow-moving wave, both believe that there will be an IT solution for the heavy documentation need. PD on the other argues that blockchain could potentially get rid of a lot of the documentation present within the industry, however, he also mentions that

this could also be done by simply digitizing the supply chain. PE argues similarly by mentioning the challenges of bill-of-ladings and other transport documents evident within the industry due to their inefficiency and lack of flexibility. When discussing the potential benefits from blockchain, he mentions:

"The ultimate goal for the entire industry would be to include the bill of lading in a blockchain [[..]] The goods could be sold when they are transported which means that the bill of lading needs to be overruled [[..]] but if it would be possible to change the bill of lading through blockchain it would become easier and that would be fantastic."
- Person E

He argues that blockchain could potentially solve these problems as changes could be made automatically within seconds, for instance when cargo is sold during transport and there is a shift in ownership. PH argues that the industry is characterized by heavy-transaction value chains and mentions that blockchain might improve such. PI mentions that the industry is very traditional and heavy regulated which has made the industry dependent on documentation. He continues to mention that for them the information flow is the hardest part due to the lack of standardisation which means that they have to adapt each document depending on the deal.

5.4.2 Data analytics

PE discussed the ability of blockchain to potentially gather, analyze and share data connected to different dimensions within the industry. For instance, the mentions the new sustainability regulations where companies are forced to monitor and report their emissions, their cargo and so on. This generates a lot of data which could possibly move much more efficient within a blockchain context. Furthermore, PH argues that there is a general development within the industry where new regulations are requiring large amounts of data and questions regarding how to collect such data and how to use it.

5.4.3 Streamlining operations

Both PA and PC mentions that blockchain can potentially streamline operations in value chains within the maritime shipping industry, where some of the third parties in such complex chains can become redundant. This argumentation is built upon the fact that the industry contains long and complex value chains including many different actors, and by implementing a blockchain solutions to such chains some of the actors will no longer participate and the operations will become more streamlined. This is also mentioned by PF who argues that blockchain might provided a needed level of flexibility in operations and improvement in a flow of information and communication.

5.4.4 Smart contracts

One of the interviewees mentioning and confirming the potential use of blockchain in smart contracts within the industry is PE, who argues that blockchain can make the contract process more efficient and also display a higher level of transparency in that process as everything can be traced. He further argues that blockchain might replace the traditional and strong business relationships within the industry due to this increase in trust and transparency.

5.4.5 Organizational capability

Several of the interviewees discusses different dimensions of organizational capability within the industry. PE for instance argues that when it comes to willingness to invest in new technology it comes down to two things; understanding the technology and having internal competence. He further argues that in order to implement the technology correctly there needs to be capabilities to do so within the organization. PD argues similarly and mentions that some initiatives that have been taken have failed because organization have not truly understood the technology and how it should be applied to their operations. Both PD and PG argue that organizations need to understand the core of the technology in order to identify the design that is applicable to their operations. PI mentions that there is a generation shift in the industry which has increased the focus on education and therefore he believes that it will increase the adaptability for new technology within the industry. PJ argues similarly by mentioning that there is a general lack of understanding from the organizational perspective as the technology has been highly academic in its nature up until now.

5.4.6 Technological infrastructure

Technical infrastructure has been discussed by several of the interviewees. PE mentions that there is a challenge in the global value chains within the industry as operations span worldwide but the technological infrastructure differs between geographical regions. This different opportunities for technological investments. PF on the other hand argues that the geographical differences in technological opportunities are quite small and not an overall problem for implementing technology within the industry. Furthermore, PG mentions that one of the common misconceptions about blockchain is that it is a ready technology, and she rather argues that there needs to be a full technological system in place before the blockchain is actually able to be implemented. PI believes that for any new technology to function within the maritime shipping industry the technological infrastructure needs to have a standardization. As it is today in the industry there is no standardization at all.

5.4.7 Traceability

Traceability is a commonly mentioned concept during the interviews where the interviewees have both referred to tracing transactions and tracing assets. PE mentions that blockchain potentially can provide the ability to trace transactions in terms of contracts, obligations and payments in order to create a secure chain of transactions where different changes or happening can be traced throughout the chain or automatized. He further argues that blockchain might enable tracing fuel consumption and emissions, as well as custom activities. The traceability is also mentioned by PF who argues that blockchain might enable a higher degree of tracing activities as well as tracing vessels or goods during transportation and PH mentions that new regulations that have been implemented needs traceability which blockchain can provide in terms of more reliable data being transferred. PG and PI discussed the fact that blockchain could improve information flow within value chains and that the possibility of increased traceability could be very helpful both for tracing goods but also for when creating contracts. Furthermore, PJ also argues that there is a lack of standardization within the industry and other communication tools such as phone correspondence are harder to trace in comparison to blockchain communication.

5.4.8 Trust

PH mentions that blockchain has a great potential to improve trust between different parties within the maritime shipping value chains in terms of a trustworthiness of information and PG argues that one of the main issues that the industry is facing is trust which is an aspect could be somewhat mitigated by implementing blockchain. However, PG also mentions that a lack of trust is one of the reasons why early blockchain projects are failing today, especially in permissioned blockchains where one company owns the technology. As PG argues:

"*In this setting, trust is the result of three factors: visibility, traceability and a combination of the two [[..]] the system needs to work for these three variables*"
- Person G

PG argues that if one of these dimensions are missing, trust will not be established fully. PE mentions that within the maritime shipping industry, there is a tradition of establishing strong and safe personal relationships in order to establish trust. Blockchain could potentially replace these relationships by maintaining a high level of trust in the technology. PI also mentions the trust dimension and argues that there is a lack of trust within the industry and that this lack of trust could make it difficult to implement blockchain. PJ on the other hand argues that trust is central within any business context and that blockchain with its transparency can provide the needed trust both in knowing that the information in the blockchain is correct but also in terms of business relationships.

6. Scenario planning

6.1 Defining the scope

Defining the scope is explained by Shoemaker (1995) as setting the appropriate boundaries for the scenario planning in terms of deciding upon the time frame, the technological dimensions to be included as well as which part of the industry to be analyzed. The boundaries and decisions decided upon at this stage has been applied to the entire process and have also functioned as the base for the delimitations presented in the first section of this thesis.

Academics argue (Shoemaker, 1995; Wulf et al., 2013) that setting the boundaries are very important as it provides the scenario planning process with a clear purpose and direction. After initial discussions with the guiding company, the purpose of investigating the future role of blockchain technology in the maritime shipping industry is set. Partly because the company representatives identify blockchain as an intriguing technology in a maritime context but also due reports identifying blockchain to have major impact on the industry in five years (UNCTAD/DTL/2018/1, 2018). Furthermore, a five-year time frame was set in this first scenario planning step due to such reports. In addition to this, Wulf et al. (2013) argues that the scope definition can be illustrated in framing checklist. This includes setting a goal, deciding the strategic level of analysis, defining relevant stakeholders and participants, as well as the scenario planning process time horizon. After the initial meeting with the guiding company and their representatives, all of these dimensions are set. The scenario planning analysis is be based on an industry perspective. The participating parties are the authors of this report, the guiding company and all of the interviewees which represent academics, maritime shipping value chain actors and experts. Furthermore, the stakeholders are the different maritime shipping value chain actors such as ports, shipping lines, freight forwarders and so on (Rushton et al., 2011). Lastly, the time horizon which represents the time period for which the scenario planning process is conducted is set to five months as this amount of time represents the time available to conduct the thesis. The framing checklist is illustrated in Appendix 4.

6.2 Perception analysis

At this stage, the perception analysis is presented. The results from the perception analysis is mainly based on the empirical findings presented in section five. The industry changes and potential future development of such are identified in order to create a more accurate perception of the industry being examined for the thesis.

All of the identified development factors for the industry, the technology and the combination of the two are gathered in order to ensure as wide coverage as possible and to make sure that no development factors are being overlooked. The first part of the qualitative interviews was used in order to locate these changes or potential developments from the stakeholders' perspectives in order to ensure that all relevant factors are identified and to pick up on weak signals that are perhaps not yet evident within literature. These wides-spanning influence factors are in the next step sorted according to set criteria and lies as the foundation for the identified trends and uncertainties. The development factors are summarized below in table 9.

Industry development	Blockchain development	Blockchain in the industry
Consolidation	Connectivity	Documentation
Price sensitivity	Security	Data analytics
Data protection	Business control	Streamlining operations
Business relationships	Value chains	Smart contracts
Technology	Blockchain design	Organizational capability
Vessel size	Transparency	Technological infrastructure
Sustainability	Scalability	Traceability
Transport volumes	Competence	Trust
Conservatism	Hype	
	Regulation	

Table 9: Summary of the development factors identified in the empirical discussion.

6.3 Identifying trends and uncertainties

At this stage, trends and uncertainties are identified and reflected upon. The development factors connected to the industry, the technology and the potential application of the technology within the industry have been the basis for the trends and uncertainties selected in this section. The developments factors have been identified from the qualitative interviews held with different actors, which were aimed at capturing different perspectives of the technology and the industry. Furthermore, the interviewees have also discussed different development factors according to their level of impact and level of uncertainty, and based on these discussion the authors placed different factors onto an impact/uncertainty grid (Wulf et al., 2013) in order to find patterns of the most crucial factors and the ones that were of no interest for the study. The critical uncertainties are the development factors placed in the far right corner of the matrix, i.e. the development factors with high impact and high uncertainty. The development factors placed in the higher left of the matrix, which are high in impact and low in uncertainty, are considered trends.

In order for the development factors to be considered a trend or an uncertainty, criteria were set for the selection. The development factor had to be mentioned or confirmed by five interviewees, it had to be relevant in regards to the scope of the study set in the first step of this scenario planning process, and it should be considered relevant according to the impact/uncertainty grid (Wulf et al., 2013) patterns. Whether or not the development factors fulfilled the requirements are summarized in table 10, 11 and 12. Depending on the placement of the development factors on the impact/uncertainty grid, by which placement is based on discussions with the interviewees, the development factors that fulfilled all three criteria are considered either a trend or an uncertainty.

	Development factor	Mentioned by five interviewees	Relevant to scope	Relevant to grid
Industry	Consolidation	✓	✓	✓
	Price sensitivity	✓	✓	✓
	Data protection	✓	✓	✓
	Business relationships	✓	✓	
	Technology	✓	✓	✓
	Vessel size		✓	
	Sustainability	✓	✓	✓
	Transport volumes			
	Conservatism	✓	✓	✓

Table 10: A summary of the development factors in terms of trend requirements for the industry

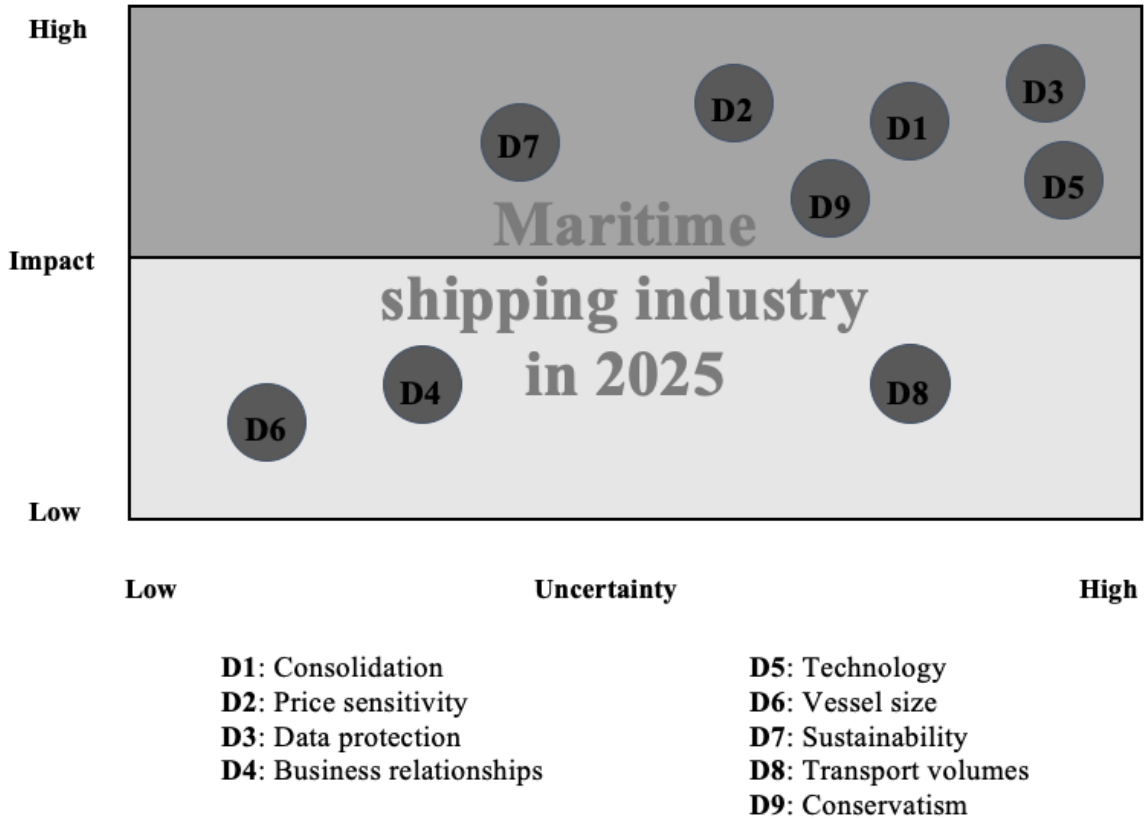

Figure 7: The industry development factors placed on the impact/uncertainty grid

	Development factor	Mentioned by five interviewees	Relevant to scope	Relevant to grid
Blockchain	Connectivity		✓	
	Scalability		✓	✓
	Security	✓	✓	✓
	Business control	✓	✓	✓
	Value chains	✓		
	Blockchain design	✓	✓	✓
	Transparency	✓	✓	✓
	Hype	✓	✓	✓
	Competence	✓	✓	✓
	Regulation		✓	

Table 11: A summary of the development factors in terms of trend requirements for blockchain

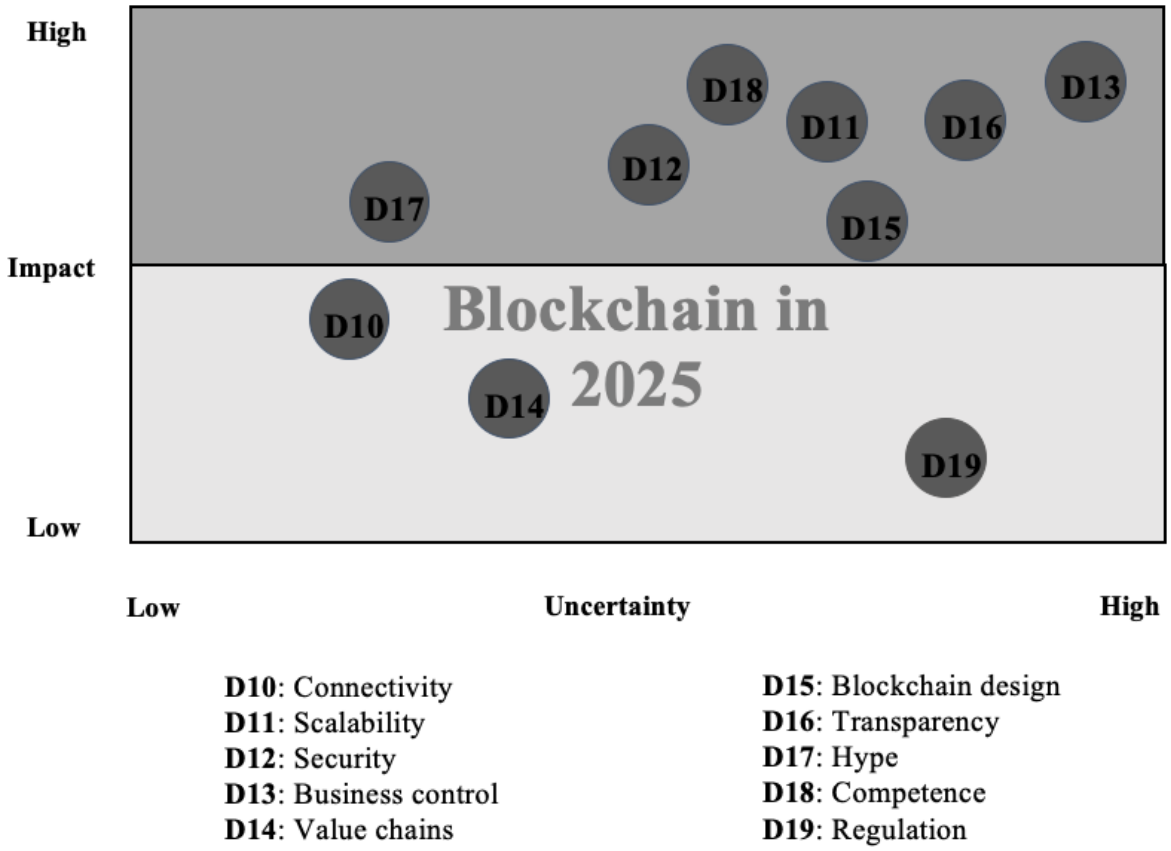

Figure 8: Blockchain development factors placed on the impact/uncertainty grid

	Development factor	Mentioned by five interviewees	Relevant to scope	Relevant to grid
Blockchain in industry	Documentation	✓	✓	✓
	Data analytics		✓	✓
	Streamlining operations			
	Smart contracts		✓	✓
	Organizational capability	✓	✓	✓
	Technological infrastructure		✓	✓
	Traceability	✓	✓	✓
	Trust	✓	✓	✓

Table 12: A summary of the development factors in terms of trend requirements for blockchain within the industry

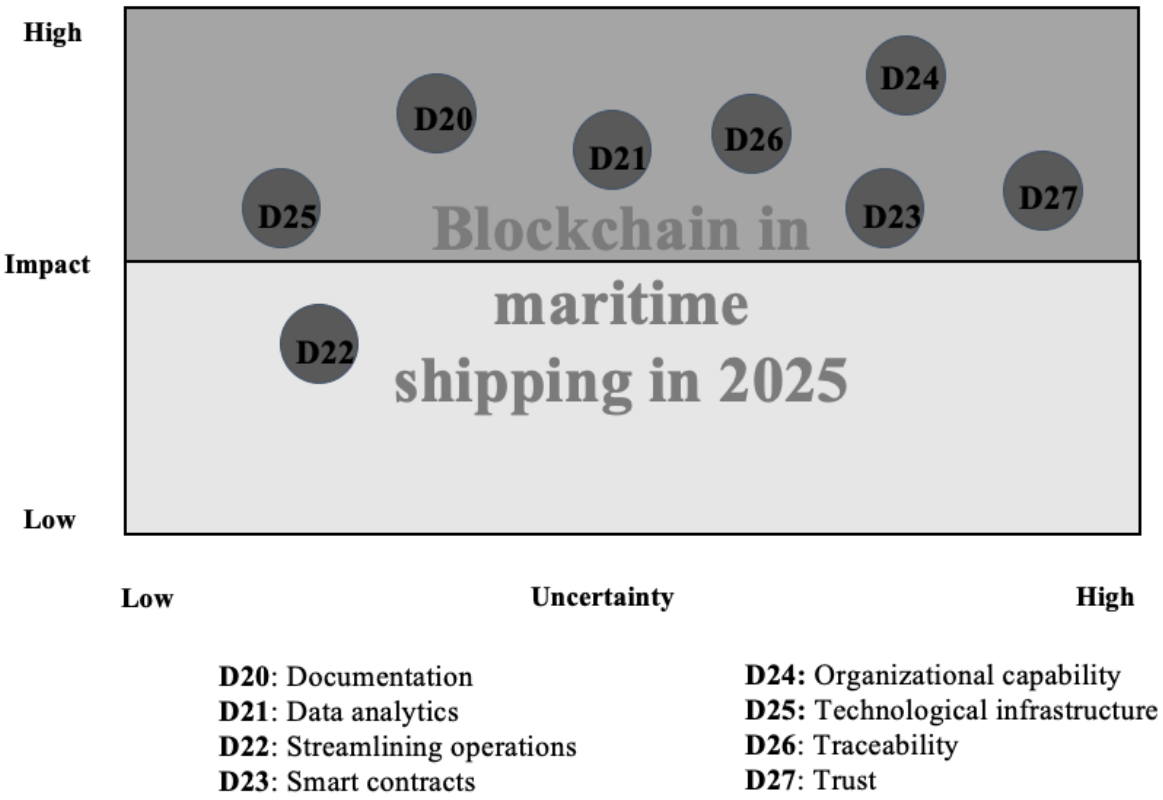

Figure 9: Blockchain in maritime shipping development factors placed on the impact/uncertainty grid

6.3.1 Trends maritime shipping industry

The trends selected from the industry development factors are presented below. There are four development factors that passed all of the criteria for being a trend within the maritime shipping industry and these are: consolidation, price sensitivity, sustainability and conservatism. The selected trends are further described below.

T1: **Consolidation**

Both the collected secondary data as well as the empirical material indicates that there is consolidation trend within the maritime shipping industry. The consolidation trend (Wiklund, 2018; UNCTAD/RMT/2017, 2017; Gonen, 2018; Laxmana, 2018) is evident as strategic alliances are forging within the industry and a new level of collaboration is present. Several of the interviewees mentions or discusses the consolidation trend and all of them expresses that the increased level of cooperation and collaboration will continue, even though the outcome of such is uncertain. This development might be connected to the low profitability within the industry, as both PC and PG argues for example, more collaboration is needed in order to create scale economies and utilize full capacity. PH also mentions the consolidation trend and argues that it is evident in all projects that are currently being processed and that new relationships between industry actors are created, and PF argues that there is a development towards fewer shipowners. However, no interviewee has been able to confidently suggest how this trend is going to impact the industry, it is hence highly uncertain.

T2: **Price sensitivity**

The maritime shipping industry is showing patterns of price sensitivity, where the industry actors are combating issues with unprofitability and continuous cost-cutting. The globalization's structural impact on global trade and transportation has created higher demand for lowering prices within the industry and at the same time improving service quality (UNCTAD/DTL/2018/1, 2018). The struggle with profitability is mentioned by several of the interviewees as PA for instance argues that long-term deals are hard to make profitable and especially working as line agents, they notice that a higher level of service is needed. PG is also mentioning this aspect and argues that it is noticeable that companies within the industry are competing on low margins which makes cost-cutting activities usual among the actors. The question of how this trend will continue and further impact the industry is highly interesting as there is a great uncertainty in terms of outcome. None of the interviewees mentioned how this trend will plan out, only that is has impacted the industry and that it will continue to do so. For example, some of the interviewees mentions that there is an overall lack of resources within the industry, which can potentially be due to the price and cost structure.

T3: **Sustainability**

A new focus directed to sustainability in operations and the general business environment is evident within the majority of industries today and also in the maritime shipping industry. A strive towards more sustainable transportation activities is present within the industry (UNCTAD/RMT/2017, 2017; SHM, 2018) and this trend is confirmed by the interviewees as well even though they might impact the different actors in different ways. One can distinguish an environmental concern both from the actor side, as argued by PH, but also from the regulative side, as argued by both PH and PF. Even though a sustainability focus has been in place for a while, the future regarding how the sustainability will impact the industry is uncertain. New legislations such as the MRV regulation (DNVGL, 2019) can potentially increase, and PH argues that the environmental ambition might increase the demand for transparency within the industry. This can be argued to have an interesting effect on industry dynamics, especially within the maritime shipping industry that has traditionally been characterized by low transparency. Other regulations such as the VGM regulation (IMO, 2019b) also need a lot of information and data to be transferred between different parties which demands systems and routines to handle such data. One can therefore argue that the sustainability focus affects the industry and will continue to do so as long as the trend continues.

T4: **Conservatism**

The maritime shipping industry is one of the more traditional industries in terms of manual handling and time-consuming processes (Watson Farley & Williams, 2018) as well as relatively slow digitization process. The conservatism is confirmed during the interviews, where a majority of the respondent mentions this aspect of the industry, although in somewhat different manners. There is a general desire and wish to be innovative and invest in technology but there is a resistance to change and to invest in new things, as mentioned by both PA and PE. Some of the industry actors have, however, expressed that the conservative climate is somewhat loosening up and starting to change. The result from such change is yet not evident. One can only assume that if the conservative climate does not change, a resistance towards

technological investments will proceed. However, as PI argues, perhaps the focus of the development should be on customer requirements in order to start from the right end.

6.3.2 Trends blockchain

The trends selected from the blockchain development factors are presented below. There are four development factors that passed all of the criteria for being a trend within blockchain technology and these are: security, blockchain design, hype and competence. The selected trends are further described below.

T5: **Security**

One could argue that all business contexts calls for a high level of security in terms of business relationships and transactions. One of the most promising features of blockchain is the level of security it can provide (Feng et al., 2018). As argued by Nofer et al. (2017), the technology can replace the validating function that third parties often provide. Both PB and PD confirms that security dimension of blockchain where the discussions concerned the high-security aspect of the traceability of transactions and hamper resistance of the technology. The security aspect is interesting to examine as some argue that there is a data security risk with blockchain as it is not invulnerable to attacks (Walport, 2016) and that organizations unsafe in such business contexts. There might hence be a dividing between the general security conception and the one provided by academics and professors within technology by which impact is not yet known.

T6: **Blockchain design**

The different designs of blockchain technology (Arsov, 2017; Bano et al, 2017) are discussed by several interviewees, both in terms of how the different designs might work in a managerial context as well as different possibilities with different chains depending on the context (Zheng et al, 2018). The designs are of major interest as different levels of decentralization in control majorly impacts not only the focal organization but whole value chains and how they are managed. Within this dimension, a separation between the industry perspective and the technology perspective is evident. The technology perspective mainly brought forward by the professors both mentions that there is only a disruptive potential in permissionless chains where the control is decentralized. The industry perspective on the other hand argues that permissionless chains will be met with more resistance as anyone will be able to access the shared data. However, one of the technology professors, PD, recognizes the difficulty of implementing permissionless chains in some industries. One of the potential solutions to this separating view on the technology is brought up during the interviews by PG, who mentions that the ownership is the most important aspect of blockchain design and that permissioned chains should be managed by a neutral partner. What types of blockchain design that will be implemented within an industry is intriguing as it might impact the business control, regulations as well as level of transparency within industry processes.

T7: **Hype**

Blockchain has been widely discussed the last couple of years and a clear hype can be distinguished from the literature promising optimistic solutions and potential application areas. However, the perspective brought forward by the technology professors (PB and PD) as the

PhD student (PG) argues that the technology has been damaged by the hype and that unrealistic expectations of what the technology can do have been emerging because of this. The effect of the hype is uncertain; however, it is very intriguing as it might impact the view that organizations have on the technology. PD for instance argues that there is an overall view that blockchain is a ready technology that can be implemented in "pre-packaged" solutions without realizing that many design decisions needs to be taken in order to actually create value for a business. The hype has given rise to managerial problems where organizations see all the possibilities without understanding the technology. The true value and the requirements need to be in focus, as argued by PG, instead of the hype. How this plays out is interesting as it might impact the level of success in pilot projects and other initiatives connected to the technology, which might ultimately impact the attitude towards it and the level of future implementation.

T8: **Competence**

New technology needs competence that can manage such a transition and since blockchain is such a novel technology it is still restrained in finding the right people with the right knowledge of it. Concerns regarding the right competence for blockchain has been expressed both from a technology perspective and an industry perspective. Both technology professors, PB and PD, argues that there is a general restriction to blockchain right now in the context of involving the right people and finding the competence that understand the technology. As PD argues, a lot of the misconceptions caused from the hype needs to be corrected and this might take longer time that expected. The focus has up until now mainly been directed towards the business side of blockchain and not so much in understanding the actual technology, which might implicate the potential application of such in terms of how willing organizations are to invest or the failure rate of future projects due to lack of competence or understanding.

6.3.3 Trends blockchain within maritime shipping

The trends selected from the blockchain within maritime shipping development factors are presented below. There are two development factors that passed all of the criteria for being a trend for blockchain within the industry and these are: documentation and traceability. The development factors that did not make the cut are data analytics, streamlining operations, smart contracts and technological infrastructure. The selected trends are further described below.

T9: **Documentation**

The maritime shipping industry is very traditional and has kept many of the almost ancient processes regarding the information flow within value chains. A lot of documentation is required, such as Bill of Ladings and Letter of credits, and often in physical forms (Rushton et al., 2010). There is a potential for blockchain technology to make value chains almost paperless, which might improve communication flow and efficiency (Opensea, 2017). The potential of reducing the heavy document-flow within industry value chains are mentioned by the majority of the respondents, arguing for the possibility to remove manual handling and very time-consuming processes and errors. With the use of blockchain, the documentation can be shared between parties within seconds, and as much documentation functions as the basis for transport contracts there will be a higher degree of transparency in activities. The interviewees

argue that the efficiency can potentially increase and in general improve the information flow which in turn positively impacts the efficiency in operations.

T10: **Traceability**
Implementing blockchain within the industry could both according to the literature (Cargox, 2018) and the different interviewee perspectives bring potential benefits in terms of tracing transactions or activities within operations. The traceability dimensions span over both physical assets and non-physical transactions and both types are involved within industry value chains. Tracing transactions in terms of contractual agreements, obligations and payments are only some examples. Tracing old contractual terms or correspondence is highly time consuming as there is a general lack of standardized procedures in doing so. Increased traceability possibilities would hence enable a more seamless information flow and communication between different value actor parties. One additional perspective to this is the traceability of data connected to the new sustainability directives.

6.3.4 Maritime shipping industry uncertainties

U1: **Data protection**
The trend of data protection is discussed by several different interviewees were two of the interviewees, PC and PE, both argues that industry actors are perhaps not willing to share data amongst each other. This can be due to the high level of competition within the industry and the fact that many actors are basically selling the same offer, which is mentioned by PC. How this trend will affect the industry is still uncertain, and both PG and PF argues that industry actors will be forced to share their data but perhaps not all type of data. PG argues that data can be shared which does not concern the core business but instead concerns scale economies and more efficient operations. Whether or not the industry actors will choose to share, or are forced to share, their data is still uncertain. One interesting take is the one brought up by PE who mentions that there is a resistance to share data, however, that new and future regulations will force the actors to do so. How the data protection trend will impact the industry is highly uncertain, however, it might impact how receptive the industry actors are to invest in data sharing technologies, especially in a highly open context.

Outcome 1: The industry becomes fully open when it comes to sharing their data with other industry stakeholders
Outcome 2: The industry enforces their data protection and is highly hesitant towards sharing their data

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U2: **Technology**
The maritime shipping industry is going through technological change where the full effects from such development is not yet established (UNCTAD/DTL/2018/1, 2018; Berg & Hauer, 2015). More than half of the interviewees discusses how the technology trends is affecting the industry where all of the respondents expresses hesitance in regard to how the industry actors will adapt to new technology and a technological progression. The interviewees are uncertain of how technology will impact the industry and when, but that technological progression will

have an effect even though there are obstacles for such. Assets are seldom switched out and there is an overall resistance to change in combination with low technological competence within many of the organization active within the industry. As argued by PA, PF and PC, someone needs to have the courage to invest in order for others to follow.

Outcome 1: The industry has fully opened up to technology investments and fully encourage such development
Outcome 2: The industry has become more hesitant towards technology investments and reinforces their traditional processes

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6.3.5 Blockchain uncertainties

U3: **Business control**

As blockchain in its purest technology form, i.e. permissionless blockchains, is built upon decentralized control this dimension creates huge opportunities for changing business control and how value chains are managed. PB argues that permissionless blockchains might create a whole new business control paradigm within industries, where the decentralization might bring forward a new market coordination behavior. This is also mentioned by PD who mentions that the decentralization might impact the classical principal-agent problem which might have disruptive effects. Hence, the business control dimension has to potential to forcefully impact the industry and the organizational processes in such value chains, the full effect of this distinguishable trend is however characterized by great uncertainty.

Outcome 1: Blockchain is fully adapted into industries as a new business model where there is no centralized control in value chains
Outcome 2: Blockchain is rejected and business models with a decentralized control becomes dismissed

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U4: **Transparency**

Blockchain is a technology that can provide real-time transparency to operations which for instance improves the correctness of data (Nicolett, 2018; Seiffert-Murphy, 2018). The transparency of blockchain is important to investigate, especially in a context of industries that traditionally have had low levels of transparency such as the maritime shipping industry due to the way it might transform information flow. The transparency dimension does not however only come with optimism, PC for instance argues that blockchain might bring undesired levels of transparency into an industry where lack of such is valued due to the high competition. Another industry actors, PI, is also hesitant towards this and argues that higher level of transparency would force down the prices even more and lower the profitability. Perhaps the value of transparency lies in sharing some data and not data regarding sensitive information, and the transparency in a regulating context where it is impossible to hamper with emission reporting data for instance.

Outcome 1: The transparency dimension of blockchain technology is completely utilized and highly valued and is a natural part of everyday business operations
Outcome 2: The transparency dimension of blockchain technology is considered as a disadvantage for business operations

6.3.6 Blockchain within maritime shipping

U5: **Organizational capability**

The organizational capability dimension has been discussed by several of the interviewees in the context of applicating blockchain within the maritime shipping industry, mainly in terms of competence and understanding the technology. Both the academic side, i.e. the technology professors, as well as the industry representatives agree that there needs to be a high degree of technological understanding if blockchain is to be implemented within an industry context. Both PD and PG mention the importance of understanding the core of the technology and the true value that it might provide, a dimension that somewhat disappears due to the misconceptions of the hype. The technology has been academically investigated; however, the practical understanding is lacking and without the competence within the organization are crucial in order to both find the right blockchain design but also configuration work processes accordingly.

Outcome 1: Industry actors realizes the importance of technological competence and internal investments are made in order to create organizational capabilities to adapt to the new technology
Outcome 2: Industry actors invest in new technology without prior technological capabilities or understanding for changing dynamics

U6: **Trust**

The importance of trust within the industry and the way that blockchain implementation might impact this dimension is discussed by many of the interviewees. Blockchain provides trust as it somewhat replaces third-party validating functions, the history of transactions is transparent (Nofer et al., 2017) and the technology is mainly tamper resistant (Zheng et al., 2018). The trust, according to interviewees, concerns that the right information is shared, and that the information can be used as it is correct. One of the interviewees mentions that problems arise when there is a lack of trust in the information that is being shared due to the fact that things needs to be double checked at manually controlled. Another aspect that is mentioned is the fact that the technology could potentially replace the traditional, strong relationships that characterize the industry. This tradition of established trust is also evident by the argumentation of PG who mentions that some projects concerning blockchain are failing because of lack of trust between participants. This lack of trust mainly stems from the blockchain design that is being used, and different levels of trust might stem from different design choices and configurations.

Outcome 1: Traditional patterns of trust in personal relationships are dissolved and a new trust is established through blockchain
Outcome 2: Traditional patterns of trust is reinforced as industry participants becomes hesitant and worried in the changing relationship dynamics

6.4 Scenario building

The actual scenario building process is initiated by conducting a correlation analysis between the different identified uncertainties. The correlation analysis is considered important as internal relationships can be located which increases the credibility of the results. The result of the correlation analysis is presented in table 13 in section 6.4.1. The next step is to generate two dimensions with four opposing outcomes which is the foundation for the themes later on used as the scenarios. The four themes are illustrated in figure 10 in section 6.4.2.

6.4.1 Correlation analysis

The correlation analysis is conducted in accordance with the procedure presented by Shoemaker (1995). The aim is to compare two uncertainties at a time in order to determine if the occurrence of one uncertainty is connected to the occurrence of the other uncertainty. If the outcome of one uncertainty increases the likelihood of the outcome of the other uncertainty to occur, the relationship is labelled with a "+", hence a positive correlation. If the relationship is the opposite, i.e. a negative correlation between the two uncertainties, the relationship is labelled with a "-". Furthermore, if the outcomes of the two uncertainties are considered to be separate and no correlation is evident, they are labelled with "x". For two of the correlation relationships, no type of correlation could be established as too much uncertainty regarding the outcome was present, these two relationships are labelled "+/-".The labels are established based on the discussions from the interviewees, and the uncertainty pairs are further discussed in the section below.

U1 Data protection and U2 Technology

If the industry becomes more open towards sharing their data with other industry stakeholders, it will require them to become more accepting of technological investments and to update their processes and operations. In addition to this, investing in new technology which requires a higher degree of data sharing will increase the will to share data as well. There is therefore a positive correlation between the two uncertainties.

U1 Data protection and U3 Business control

If blockchain is fully adapted as a new business model where control is decentralized, data sharing naturally increases as all parties participating in industry value chains have access to the same information. The opposite is correct as well due to the fact that when data sharing increases significantly and the will to share data, the business control somewhat becomes more decentralized as well in comparison to the present model. The correlation is therefore positive.

U1 Data protection and U4 Transparency

Blockchain can provide a high level of transparency to operations, however, if industry actors are not willing to share their data the level of transparency will remain the same. Therefore, if industry actors have fully adapted to sharing data with other participants, then there is a possibility for blockchain to increase the level of transparency as well. Thus, a positive correlation is evident.

U1 Data protection and U5 Organizational capability

If industry actors are fully committed to achieving organizational capabilities connected to technological understanding and adaption, such development can be achieved without the actors changing their level of data protection preference. Furthermore, industry actors can be fully committed to sharing their data without making significant investments to develop technological capabilities or competence of blockchain. Because of this, no correlation can be found between the two uncertainties.

U1 Data protection and U6 Trust

Even if industry actors are fully committed to increase their data sharing with other actors, it does not necessarily mean that the trust for the technology increases. One of the more important aspects of trust in this context is the trustworthiness of data and this aspect, everything else equal, is not affected by increased willingness to share information. Even though larger amounts of information are being shared within the industry, the correctness or trust in such is necessarily not impacted. There is therefore no correlation found between these uncertainties.

U2 Technology and U3 Business control

There is no evident correlation between technology investments and the level of decentralization in business control. Industry actors can become willing to invest in new technologies and ready to adapt their business to such, however, this does not mean that the level of decentralized control will either decrease or increase. Hence, no correlation is evident between the two uncertainties.

U2 Technology and U4 Transparency

Most likely, if technological investments are considered very important and a crucial part in moving forward within the industry, the transparency will be valued higher and be a more evident part of everyday operations. New technology can perhaps also add a higher level of data accuracy and decreasing the level of manual handling evident in value chains and therefore increase the level of transparency as data is collected in a new and more efficient way. Hence, there is a positive correlation between the two uncertainties.

U2 Technology and U5 Organizational capability

As evident from the discussions with the interviewees, many organizations believe that technology is very important and they invest a lot of resources into doing so, however, they do not invest in their organizational capability which makes the overall technological performance to decrease. One can therefore distinguish a weak negative correlation as new technological investments often results in a lower organizational capability.

U2 Technology and U6 Trust

One can argue that having the courage and motivation to invest in technology does not necessarily impact the level of trust between different business parties. Some of the results from the empirical discussion indicates that even though organization within the industry invests in technology, they believe that the trust will remain the same. If there is a small correlation due to the fact that technological investments might impact business relationships, it is as solid evidence to be used as a correlation for this analysis. Thus, no correlation between the two uncertainties are determined.

U3 Business control and U4 Transparency

If decentralized business control becomes more accepted, the need for transparency will increase. The need for transparency will increase because value chains will not be coordinated by one central authority, but instead full visibility of transaction and members is established. Furthermore, if decentralized business control is rejected and centralized solutions are valued, the need for transparency will also decrease. Therefore, there is a positive correlation between the two uncertainties.

U3 Business control and U5 Organizational capability

One can argue that the level of adoption of decentralized control can negatively influence the level of organization capability as the incentive to invest in internal capabilities might be lost as the control is decentralized. The new control configuration might impact the level of internal accountability and blurr traditional business frames which might impact the investments in technological competence and organizational competence negatively. Because of this, a negative correlation is evident.

U3 Business control and U6 Trust

If new business models are fully implemented where decentralized control is in focus, the level of trust will either increase or decrease, which makes the correlation hard to establish. The decentralized control might either increase the level of trust both in transactions and information, but also between business partners or other value chain participants or decrease the level of trust in such due to the lack of accountability and human contact. How this relationship would plan out is highly uncertain, and too speculative to establish in terms of positive or negative correlation.

U4 Transparency and U5 Organizational capability

One can argue that the level of transparency or the need for such stands independent in relation to how willing industry actors are to invest in competence and organizational capabilities. The outcome from either of the two uncertainties does not correlate as they do not affect each other.

U4 Transparency and U6 Trust

Transparency is one of the important dimensions of trust, where visibility in transactions and full disclosure of events works as factors increasing trust in relationships. If transparency within value chain increases, the trust in both the correctness of data that is being shared and the trust in transactions and obligations increases. Furthermore, increased transparency in

emission regulation data also increases trust between the participating actors in such transactions. Hence, the correlation between these two uncertainties are strongly positive.

U5 Organizational capability and U6 Trust

The correlation between the level of organizational capability and the level of trust in value chains is conflicting. If companies fully invest in competence and technological capabilities, it might provide a higher level of trust between business parties as correct technologies are applied and true value from such can potentially be derived. However, investing in competence and new technological solutions might also decrease level of trust depending on what type of technology is applied. There are different design choices and configurations of blockchain that might impact the outcome differently depending on the context to which it is applied. Hence, one cannot establish neither a positive nor negative correlation between the two without going into specific details.

Uncertainty pairs	Correlation	Uncertainty pairs	Correlation
U1 + U2	+	**U2** + **U6**	x
U1 + U3	+	**U3** + **U4**	+
U1 + U4	+	**U3** + **U5**	-
U1 + U5	x	**U3** + **U6**	+/-
U1 + **U6**	x	**U4** + **U5**	x
U2 + **U3**	x	**U4** + **U6**	+
U2 + **U4**	+	**U5** + **U6**	+/-
U2 + **U5**	-		

Table 13: A table illustrating the uncertainty pairs and their respective correlations

6.4.2 Dimensions

In this step, the two most critical and driving uncertainties (Lindgren & Bandhold, 2003) are chosen in order to represent two dimensions of future change. The two uncertainties, when crossed together in a matrix, illustrates four widely differing outcomes. This step is important in order to fully understand the uncertainties connected to the industry and provide guidance in future change (Lindgren & Bandhold, 2003). The two uncertainties chosen in this step were selected based on how often they were mentioned during the interviews, the potential impact they might have on the industry and the extent to which they are uncertain in their outcome, which are all aspects that were discussed during the interviews.

Dimension 1: *Traditional patterns of trust vs technological patterns of trust*

One of the most critical uncertainties for the future development of blockchain within maritime shipping is the patterns of trust within the industry. The two extremes in outcomes can be represented by the industry to either keep their traditional patterns of trust based on strong relationships or that the industry creates a new type of trust in value chains based on technological advances. These two different extremes will have a radical impact on industry dynamics as it might impact value chain configuration as well as business operation design. Furthermore, the patterns of trust might impact how business relationships evolve and the willingness of implementing new technology.

Consolidation is one of the more frequently mentioned trends (Wiklund, 2018; UNCTAD/RMT/2017, 2017; Gonen, 2018; Laxmana, 2018) which can be argued to have a significant impact of the patterns trust within the industry. When larger companies within the maritime shipping industry are merging and creating new alliances and collaborations, it might affect the power structure in the market and create a weave of unease amongst industry actors which ultimately might impact the trust in such chains. Trust have different dimensions and technology might be able to replace these if applied correctly, if the technology does not provide guidance in all dimensions it might not be endorsed. As argued during conversations regarding trust:

"In this setting, trust is the result of three factors: visibility, traceability and a combination of the two [[..]] the system needs to work for these three variables"
- Person G

Even though the impact of the type of trust within the industry might have huge effects, the outcome of such development is yet highly uncertain. The trust dimension was discussed thoroughly during interviews; however, none could provide a solid solution or consensus regarding how the industry patterns of trust will develop.

Dimension 2: *Full transparency in value chains vs no transparency in value chains*
One of the major benefits of blockchain technology is the high level of transparency that it might provide in value chains and business operations (Nicolett, 2018; Seiffert-Murphy, 2018). The transparency has been argued by professors to be one of the most prominent and value-providing characteristics of the technology by for instance providing the opportunity of creating new types of services. However, there is still a great uncertainty in terms of how industries will actually receive this transparency, especially in the maritime shipping industry due to the high level of conservatism and business privacy.

"*Blockchain and other technologies can be a way for authorities to verify the transparency [[..]] many shipowners are family-owned which means that they do not have the same level of transparency as listed companies*"
- Person F

The two extreme outcomes from the uncertainty surrounding the future level transparency in value chains are either that industries adapt to having full transparency in operations and are showing a willingness to share transactions and activities or that organizations keep their operations private and closed off from other industry participants. These two outcomes might have a strong impact on the future of business as it might as full transparency would radically change the competitive climate within industries and how industries will react to new requirements for increased transparency is still hard to distinguish.

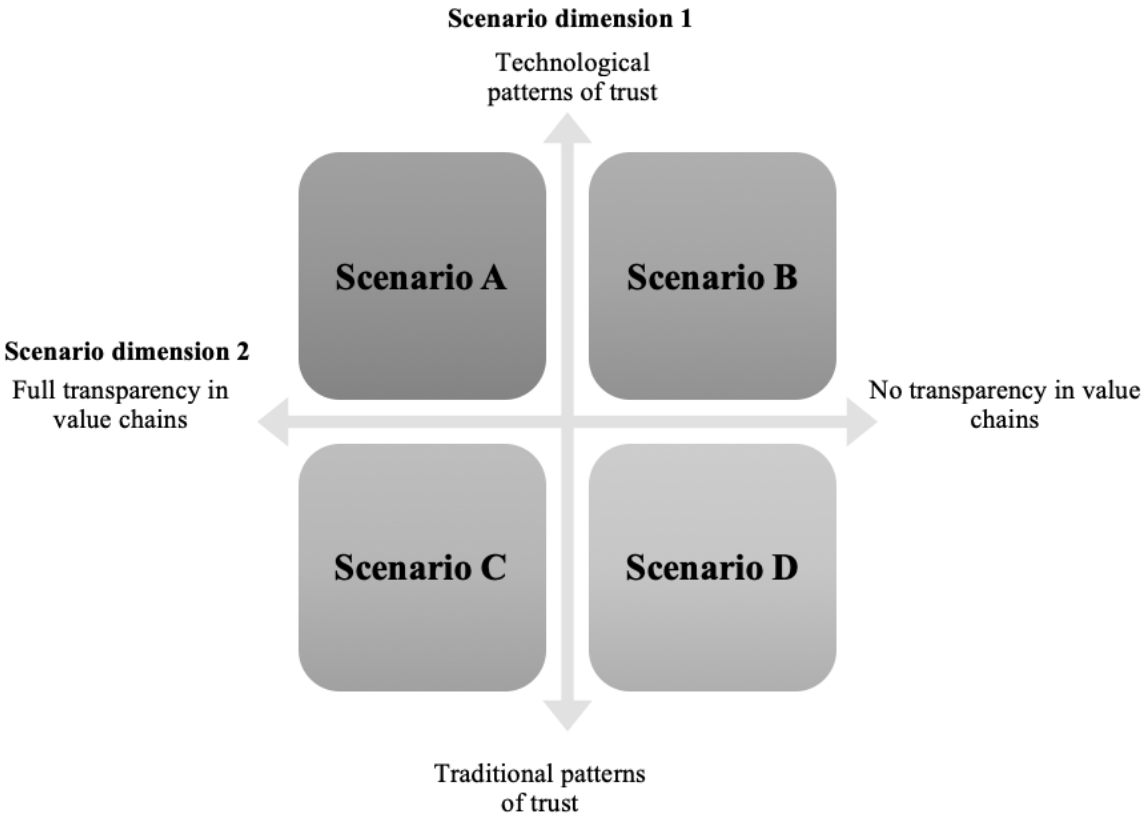

Figure 10: The chosen critical uncertainties illustrated in an adapted scenario matrix from Lindgren and Bandhold (2003)

6.5 Checking for plausibility

In this step, a process of validating the scenarios is initiated. The four different scenarios constructed in step 6.4 were checked for plausibility before writing the scenario theme storylines. This in accordance with the argumentation of Schoemaker (1995) who mentions the importance of continuously controlling the quality and consistency of the scenarios. The interconnections are illustrated based on the discussions with the interviewees in terms of which trends might impact the scenarios and how they connect to the uncertainties. The relationships are displayed in Figure 11. As Shoemaker (1995) argues, the test is based on the following questions: - Are the constructed scenarios credible for the chosen time frame? - Are the scenarios and the uncertainties correlating in a correct way?

The consolidation trend (T1) has been one of the more interesting trends for the future development of the maritime shipping industry, where the level of consolidation and concentration of major market players might have huge effects on the way technology (U2) is applied within the industry as well as the level of organizational capability (U5) that is developed. Organizational capability will also impact the level of how blockchain competence (T8) evolves as well as how the sustainability trend (T3) develops because finding technological capabilities and will to progress will affect the organizations' abilities to work with sustainability issues and acquirement of blockchain competence. The ease to which technology is applied within value chains is also dependent on how the conservatism trend (T4)

further evolves by more or less opens up the industry and loosens old traditions of doing business which sometimes obstructs such implementation.

How the conservatism within the industry evolves further impacts the level of data protection (U1) as the traditional ways of doing business increases the level of protection whilst a potential dissolvance of the conservatism might do the opposite. The level of data protection is also affected by how the technological competence develops, blockchain competence is at the moment inadequate and if the level of competence improves the need to protect data can decrease. The extent of data protection within maritime shipping industry will also affect the design choices of blockchain (T6), where a decrease in the need to protect data might enable a more open mind for permissionless blockchain, argued to have the most potential. The level of protection will hence also affect how business control (U3) evolves within maritime shipping organizations and different design choices affect the level of decentralization in control of value chains and operations. This business control in turn has great impact in both of the scenario dimensions.

How the industry copes with sustainability issues and regulations will also impact the traceability (T10) dimension that blockchain can provide to the maritime shipping industry, mainly in terms of increased sustainability concerns and initiatives to create greener shipping operations can affect the need for traceability in such. Furthermore, if blockchain improves the traceability of transactions, both physical and financial, within the industry then the opportunities of different levels of decentralized control rises.

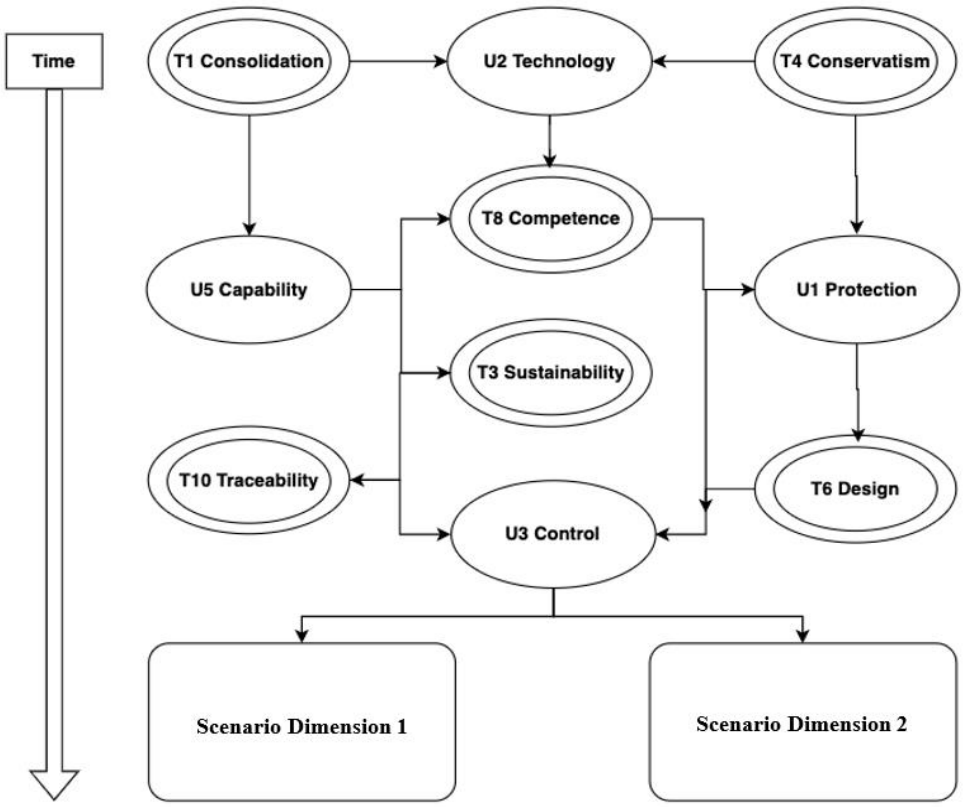

Figure 11: Influence diagram, inspired by Lindgren & Bandhold (2003), illustrating the consistency and events of the scenario building

Scenario A

Scenario A is a combination between outcome 1 for U6 and outcome 1 of U4. This means that the scenario frame is based on a future where the pattern of trust is based on technology and full transparency is evident in value chains. One of the more prominent trends evident from both the literature review and the empirical discussions is the trend of increased levels of consolidation within the maritime shipping industry. If the level of consolidation continues to increase, one can argue that the level of technological adoption and implementation will be impacted as more value chain participants and larger organizations calls for improved technological possibilities for ensuring high quality information sharing as well as coordination. From this technological development, the need for improved competence arises and the need to protect data decreases as a consequence from this development. When the industry starts to trust the technology and lower the desired level of data protection, business control will most likely become more decentralized which ultimately leads to higher levels of transparency and higher levels of technological trust.

Scenario B

Scenario B is a combination of outcome 1 for U6 and outcome 2 for U4. This means that the scenario frame is based on a future where the pattern of trust is based on technology and no transparency is evident in value chains. The consolidation trend strengthens, and the industry continues to become willing to cooperate and build alliances. This leads to fewer competitors and a different power balance within the market. When consolidation increases within the industry, the investments in internal organizational capabilities increases as organizations needs to find internal valuable structures as they become independent and new type of competition arises. As individual organization become more dependent on large chains of connected business entities, they most likely start to invest in technological competence within themselves to improve coordination of participants. When organizational capabilities improves, the focus on sustainability and the ability to tackle such requirements increases as well and sustainable operations calls for improved traceability possibilities. The consolidation trend creates a concern within the industry as the dominant players receive more power, this in turn creates a desire to protect the own business and centralize control. A higher degree of centralized business control leads to less transparency in value chains within the industry and most likely trust is based on the technology as new competence has been gathered and internal capabilities has become stronger.

Scenario C

Scenario C is a combination of outcome 2 for U6 and outcome 1 for U4. This means that the scenario frame is based on a future where the pattern of trust is based on traditional values and full transparency is evident in value chains. Another prominent trend identified throughout the scenario planning process is the conservatism within the maritime shipping industry which ultimately impact several dimensions in future change. Within the chosen time frame, the conservatism within the industry can most likely remain the same or very slowly loosen up. If traditional values within the industry loosen up, the willingness to invest in new technology will slowly increase even though some of the traditional relationship patterns will remain important for industry actors. As new technology is applied, new competence will become

important and organization will most likely invest in such although trust remains in human contact. As technological competence increases the industry actors' possibilities to design blockchains that suits their need better arises. The increase in competence will also create possibilities to use the technology in more efficient ways also arise, creating less need for data protection and information flow. The increased competence will affect industry actor's possibility to choose a blockchain design that suits their need better, making blockchain more useful. When the demand to protect information decreases, the business control becomes more decentralized which improves transparency within the industry and trust remains mostly in strong relationships due to the conservatism trend still remains and is changing very slowly.

Scenario D

Scenario four is a combination of outcome 2 for U6 and outcome 2 for U4. This means that the scenario frame is based on a future where the pattern of trust is based on traditional values and no transparency is evident in value chains. As mentioned, the conservatism trend has been identified as one of the changing dynamics within the industry, there is still a possibility that the level of conservatism will only decrease to small extent as a backlash against the rapid changes that industry actors are hesitant towards. This backlash can be argued to be a natural consequence of an industry in rapid change where industry actors expresses a concern in regard to recent events. If the conservatism only decreases lightly, the level of data protection will most likely remain the same and organizations will feel a need to protect their customer data and freight rates. This might ultimately impact what technology the industry will focus on and a decentralised business control is highly unlikely to be used. Since a centralised business control will create less of a demand for transparency within the industry and increased trust is based on traditional values from increased conservatism and a centralization of business control will be reinforced.

6.6 Scenario storylines

In this step, the four scenarios describe in the previous section will be described in further detail in a narrative nature. Assigning the four created scenarios with headlines and a storyline describing the narrative of future events is important as it might guide future strategic actions (Wulf et al., 2013) and to enable a visualization of the future (Lindgren & Bandhold, 2003). The scenario storylines both includes a story-telling part where the reader can fully visualize the future during the set circumstances, as well as a descriptive part where the relationship between different trends and uncertainties are explained, and the challenges and opportunities with blockchain during such circumstances. The scenario storylines are described below.

Scenario A

"A new era for maritime shipping"

An employee working at a shipowner is on his way to work. There are only a few shipowners in the market and the competitive climate has changed since he started working within the industry five years ago. He remembers the old traditions that slowly faded away as new technology was introduced in the market and the major players within maritime shipping slowly but steady started to increase transparency within their value chains. He is relieved that processes have become more efficient, information is exchanged real time within a permissionless blockchain which has made the organizations in the value chain almost paperless. He is glad that the industry started to find trust and security within the technology, instead of basing all business trust within old relationships. Nowadays, less time is consumed by correcting errors or searching for the right information, blockchain has made it possible to trust the information received but also to trust contractual obligations as transactions within the chain cannot be changed. They can now offer their customers rapid service, a higher degree of flexibility and higher quality service due to improved information flow. With the introduction of permissionless blockchains, business control became more decentralized and organizational structures within the industry were disrupted, creating a new era of maritime shipping.

Blockchain is one of the technologies that have been introduced into the market, as new competence regarding such opportunities have evolved. The major hype caused from the media has worn of, and actors within many industries have learned the true value that blockchain can bring and furthermore for which context that it should be applied. A few of the major players took the initiative to create pilots in order to find the right fit for the technology within the industry, and other industry actors joined in. The permissionless chains have created a disruption of both industry activities and service providence, as well as organizational business control. Information is now shared in real time, less errors occurs due to manual handling and the system is used for tracking vessels and finding optimal routes (IHS, 2017). Within the permissionless chains, the decentralization of business control has changed the dynamics within the business climate. No one truly controls the blockchain, all transactions permissionless and visible for everyone. This has certainly changed the trust dimension within the industry.

In this era, a new type of trust and transparency is in focus. Third-party actors have been a source of trust within maritime value chains; however, they have also contributed to time- and resource consuming activities. With the introduction of blockchain, that have been focused on very nished activities have changed the nature of their work. Line agents for instance have long been struggling with the huge amounts of paperwork and authority reporting, but within the new efficiencies from blockchain they have accelerated within customer service and shipping service development instead. Hence, a value chain configuration has been evident which has changed industry dynamics. Blockchain has provided the need for transparency but also the security and trust in information somewhat provided in the traditional value chains, actors are

together working in decentralized synergetic platforms where cooperative efforts lead to new business models and new services (Bussman, 2019). The scalability problem of blockchain has been solved in business synergies (UNCTAD/DTL/2018, 2018) where companies within the industry have worked together in successful implementation.

Scenario B

"Halfway there"

Three employees enter a conference room to participate in a meeting. They are excited as the meeting is reviewing the new permissioned blockchain that has been implemented in their organization. Technological investments and the trust in novel technology is now an everyday business agenda in comparison to earlier days where they experienced a high level of hesitance and concern regarding the technological development and what it might bring. The consolidation trend within the industry caused the major players to implement permissioned blockchains as the power balance somewhat shifted and actors were highly worried that full transparency would jeopardize the own business and the competitive forces from such. One of the employees recognizes the fact that the maritime shipping industry has truly started to trust the technology as traditional trust created from third-party actors have shifted into a technological trust manifested in blockchain transaction and visibility. The old ways of inefficient processes and activities are long gone, and industry actors utilizes the time traditionally spent on correcting errors, changing bill of ladings and sending the same information several times to the same parties by improving operations and making them more efficient and sustainable in terms of full load capacity and slow steaming. The business control is still centralized, but the three employees going into the meeting are full of ideas of how to use the technology to progress further.

The consolidation within the industry has caused a chain reaction where transparency has become less valued as industry actors are concerned with the new and strong power imbalance within the market. Industry actors have become more inclined to invest in new technology and to find internal competence in doing so. The organizational capabilities to find the right competence and adopt activities to the gained efficiencies evolves and a trust in technology is established instead of putting all trust on third-party actors. When organizations started to realize the importance of new technology and new pilot projects were launched, the industry actors together spurred each other into technological evolution. The need to protect the own business and a feeling of increased fierce competition has led to the introduction of permissioned blockchains, where one of the major players controls the blockchain and the information in such. The hesitance towards transparency have further increased as the permissioned blockchains have been introduced, however, organizations are finding a higher level of trust in the technology and are moving away from the traditional strong personal relationships with other organizations as these are too inefficient and time consuming. In addition to this, permissioned blockchains have been viable as prior relationships have existed but when the chain is established, the trust has shifted into relying on the technology.

As permissioned blockchains does not provide any new organizational structures in terms of business control, the focus of the blockchains are rather on IoT context (Marr, 2019; Rands, 2018; Bussman, 2019) where all devices, documents, reporting functions, trackers and information are connected into one platform utilizing the new efficient exchange of transactions. Actors have come to the understanding that it is important with authorized participants (Ksherti, 2017) and are not yet ready for full transparency. Not sharing all data or choosing to share data with only a number of organizations within a chain can improve the feeling of security, however, the transparency that is valuable in order for the maritime shipping industry to move forward is jeopardized.

Scenario C

"There is no trust like human contact"

A representative for a line agent is going into a meeting with a shipowner, their business relationship has grown stronger over the past five years and they have continued to build a strong trust between each other. Since the representative for the line agent company started working in the industry, strong relationships have continued to be of importance for the industry. However, there has been other developments as well. The interest to invest in new technology has been evident even though such transitions have been slow. Nowadays, industry actors have found an interest in permissioned blockchain in order to retrieve valuable information about the shipowners such as freight rates and location of ships. However, due to the lack of trust in the technology and the need for human relationships, the progress is still in a pilot phase without widespread adoption. Before meeting the shipowner, the line agent has just been to a seminar regarding blockchain to increase her competence, during the past five years the line agent has increased their focus on strengthen the technological competence that they have. This have made them realize that the level of data protection that they have is unnecessary and they understand the value from decreasing such levels. During the meeting, the line agent is starting to understand the benefits from using permissioned blockchain, and that several highly interesting pilot projects are evident within the industry at this time.

The conservatism within the maritime shipping industry has been easing up and slowly continues to do so as time passes by. The focus towards technology has increased for all actors within the industry as the demand for a higher level of transparency has evolved. Tracking emissions and finding optimal routes are only some of the tougher sustainability regulations that have entered the industry. This has changed the industry in terms of higher levels of transparency, however, the core beliefs are still evident in terms of the trust being based on traditional values and human contact. With the new technological focus, the industry actors have increased their technological competence which has created a higher level of technological knowledge and an interest for the possibilities of blockchain. The new technological competence has made it possible for the different industry actors to create a

greater understanding for which blockchain design that should be applied to specific needs and when the technology actually provides value for a business.

One of the possible reasons for why the industry has remained traditional in their patterns of trust is partly due to the hype surrounding blockchain that was evident five years ago. The hype hindered the industry's possibility to completely see the value from blockchain as the benefits from such was over exaggerated and managerial concern arose when the technological constraints were not understood properly. As the conservatism within the industry, causing time consuming processes and manual handling in operations, have slowly decreased the industry actors have had time to comprehend different technological options and how they can provide value for the value chains. However, cultural barriers have been very high and trust is still created through strong relationships even though patterns of blockchain interest and pilot projects can be distinguished.

Scenario D

"Industrial inertia"

At the line agent's office, the phones are always ringing, and several data systems are used for each customer. One of the employees spends the majority of her day on writing bill-of-ladings, confirming information, talking to customers and other industry actors as well as correcting manual errors. In her opinion, the industry has not changed as much as she anticipated since she started working there five years ago, the conservative pattern still remains. She expected the industry to become more digitized, but the industry is still slow-moving. She initiates a new digital project within the company in order to implement a single system instead of having several systems for different customers. However, the industry has no trust in the technology and industry actors still expects human contact and traditional ways of doing business. Furthermore, the board wants to protect their data which means that they are resistant toward any new technology that could lead to a higher level of transparency within the value chain. The employee pitches an idea where a permissioned blockchain can be used internally by connecting all relevant parties together in a seamless chain of information, but the initiative is shut down as her colleagues does not understand the value that the new system could provide. Although disappointed, the employee understands that the reason for the resistance is stemming from the backlash caused from the industry turbulence that came from the rapid changes a few years ago. Instead of cherishing the possibilities of a changing business climate, cultural barriers caused industry actors to become less transparent and less trusting in the technology.

The conservatism within the industry has slowly improved and traditional patterns have loosened up, however, such development has been too slow. The maritime shipping industry was in a state of rapid change and turbulent restructuring, where industry actors became concerned with the potential future changes. Ultimately, this led to a backlash against new technology and novel processes, in the end strengthening the already existing beliefs in

traditional procedures and relationships. The potential disruption the industry stood before five years prior was neglected and instead a hesitance against change arose. Industry actors are more closed off and focused on protecting their data and keeping the level of transparency low between value chain actors as well as external actors. Furthermore, companies become more focused on centralizing their business control as they fear that a decentralization of business control might harm the organization. The trust that industry actors put in their strong business relationships are strengthened as they have become more protective of their operations. In the new business climate, there is neither interest nor room for blockchain as the low level of transparency does not create a need for such technology. Blockchain remains a buzzword within the industry but no actors have the courage to invest in pilot projects to find valuable solutions for such, instead companies within the industry invest in smaller technological advances based on simple digitization processes.

7. Conclusions

7.1 Background to conclusions

The maritime shipping industry is responsible for tremendous amounts of goods being transported worldwide making it a significant actor impacting both the global economy and a wide amount of other global industries (Rodrigue, 2007). Albeit an industry with conservative processes and strong traditional values, maritime shipping is slowly starting to change. Several new technologies have emerged within the maritime shipping context, one of them being blockchain (UNCTAD/DTL/2018/1, 2018). Blockchain is a technological system which distributes data through electronic transactions, however, no third party acting as a validator is needed (Nofer, Gomber, Hinz & Schiereck, 2017; Seiffert-Murphy, 2018). The different types of blockchains have different characteristics and thus have the potential to provide different types of value in different business situations. For instance, blockchain can potentially improve the information flow within the maritime shipping industry as the documentation needed for business processes might improve in efficiency (Cargox, 2018) and transparency in operations increase (Watson Farley & Williams, 2018; Opeansea, 2017).

Despite great potential to provide value for the industry, the subject of blockchain within a maritime context is somewhat academically unexplored. As the industry is such an impactful actor within the global economy, the future should be examined in order to pinpoint some of the future dimensions of the industry. From the study, it became evident that the industry dynamics are changing even though the pace of change is slow. Moreover, as the maritime shipping industry is going through such changes, managers needs to be prepared for what the future beholds in terms of technological development and how to respond to such changes.

7.2 Answer to research question

The purpose of this thesis has been to investigate the potential role of blockchain within the maritime shipping industry in five years. In order to fulfil this purpose, the following research question was stated:

What is the potential role of blockchain technology within the maritime shipping industry in five years?

In order to answer the research question, a scenario planning analysis was conducted which resulted in four plausible future scenarios for the industry of maritime shipping where blockchain technology play different roles depending on the scenario characteristics. Based on the study findings, the two identified scenario dimensions of future change where the pattern of trust and the level of transparency within the industry. These two dimensions were considered as being highly uncertain in terms of industry impact but still highly relevant for future change. When crossing the two selected dimensions in a scenario matrix (Lindgren & Bandhold, 2003), four future scenarios emerged. The scenarios and their characteristics are summarized in table 14.

	Scenario A	Scenario B	Scenario C	Scenario D
Patterns of trust	Technological	Technological	Traditional	Traditional
Transparency level	High	Low	High	Low
Blockchain role	Permissionless blockchains are significant value providers	Permissioned blockchains are value providers	Blockchain initiatives have been taken without widespread adoption	No role for blockchain technology

Table 14: Main dimensions of the scenarios summarized

Scenario A: "A new era for maritime shipping"

The first scenario represents a future state where the patterns of trust within the industry have shifted from being based on traditional strong relationships towards being based on technology. Investments in technology are more widespread within the industry, the technological competence has overall increased as investments goes up and the industry actors does not feel the same need to protect their data in the same way as five years before. The level of transparency is therefore high and blockchain has become a realistic option in order to meet the new demand for transparency and to coordinate value chain actors and collaborations. Hence, the industry is prospering and is to a larger extent moving away from its old ways of doing business, entering a new era. Permissionless blockchains creates true disruption of business processes as well as revolutionizing business control.

Scenario B: "Halfway there"

The second scenario represents a future state where transparency has become less valued as consolidation within the industry has created a power imbalance amongst industry competitors. Organizations are investing more heavily in technology and organizational capabilities as they have understood the importance of technological development and the value that such might bring. Sustainability concerns continues to impact the industry and the need for tracing routes or emissions progress. However, due to the power imbalance, many industry actors are turning inwards and display patterns of protecting the own business. The demand for traceability and coordination but a decrease in transparency turns permissioned blockchains into a viable technological option into combating business challenges.

Scenario C: "There is no trust like human contact"

The third scenario represents a future state where the deeply rooted conservatism within the maritime shipping slowly loosens up and investments in technology becomes a priority, new technological competence is gathered and a new understanding of such technologies is established. Transparency is valued highly and there is an overall increase in the demand for transparency due to collaborations and synergy effects as well as increased importance of sustainability concerns. With the new gathered competence, industry actors are slowly understanding the value that different technologies can provide, the hype worn off and organizations have worked towards understanding the core of the technology even though the slow development in the conservatism trend causes a reinforced belief in strong relationships

as trust in value chains. Pilot projects with permissioned blockchains have been initiated within the industry, however, no widespread adoption is evident.

Scenario D: "Industrial inertia"
The fourth scenario represents a future state where the rapidly changing business climate and too slowly loosening conservatism within maritime shipping caused a backlash against change, and industry actors have become concerned with the pressure to change business processes. The need to protect data is highly evident and transparency is viewed as something threatening the own business. Trust is still established in traditional patterns of strong relationships and sharing information or data is done in strict moderation. Traditional business processes and activities remains, and new technology is not trusted. During these circumstances, blockchain is not of interest for industry actors and investments in such are missing. Within a business climate valuing low levels of transparency and where industry actors do not trust the ability of the technology to improve efficiency and resource consumption, blockchain cannot provide value.

To summarize, the potential role of blockchain technology within the maritime shipping industry in five years depends heavily on the future characteristic changes within the industry. The four scenarios identified in this thesis provides wide-spanning technological insights, but the true future role of blockchain within the industry is dependent on how the level of transparency and the pattern of business trust further evolves. The authors argue that within five years, the patterns of trust will most likely still be traditionally based due to the strong cultural barriers within the industry identified from the discussions with industry participants. Furthermore, the level of transparency will most likely have increased as new demand for transparency in operations is already evident. Hence, scenario C is according to the authors the most likely future scenario to occur in five years. This means that the role of blockchain technology within the maritime shipping industry in five years will plausibly be a technology in the pilot phase without widespread adoption, but with a promise of great industry value providence. In order for blockchain to be widely accepted, industry actors and participants needs to collaborate and have the determination and inspiration to move away from some of the traditional dimensions of doing business and simply move towards a more technologically viable future.

7.3 Implications for future research
This thesis has contributed to the sparse literature concerning the future role of blockchain within the maritime shipping industry as well as managerial insights into what the future within the industry might bring and the important concepts connected to such change. Several observations have been made in terms of the value that building upon such results can provide.

Firstly, as already mentioned some of the steps within the scenario planning approach have been removed for this thesis due to the scope and the purpose of such. All of the scenario planning methodologies (Shoemaker, 1995; Wulf et al., 2013; Lindgren & Bandhold, 2003) presented in this report includes a follow-up phase where the scenario developments are scrutinized and iteratively adjusted. To build upon this study, such measures can be taken in

order to track and monitor the development of the industry and the constructed scenarios as many of the identified trends and uncertainties are of major interest. One of the more prominent findings is the level of decentralization of business control that blockchain can provide, a concept that could potentially disrupt entire industries if accepted and adopted by industry actors, making it a natural candidate for future research.

Secondly, as mentioned in the delimitations section this scenario planning analysis has been focused on plausibility instead of probability (Ramirez et al., 2017). However, great value could possibly come from including probabilistic measures in order to track future industry change and the role of blockchain. Building upon this thesis, probabilistic methods could be used in order to find the most probable scenario for blockchain within a maritime shipping context. This would provide a more quantitatively based result where one scenario could be identified as the most probable and therefore most managerially relevant.

Lastly, as maritime shipping is an industry going through several interesting changes, looking into some of them more in-depth would provide the research with intriguing dimensions. Development factors such as the patterns of trust within the industry or the level of transparency should be examined more in detail, especially in a macro-economical perspective and how such phenomenon could potentially affect the global economy.

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Appendix

Appendix 1 - Interview guide

Introduction

The interviewers initiate the conversation by having short introduction to the interview subject and the intentions of the study.

The Maritime shipping industry is currently undergoing major changes where competition is fiercely increasing and the ever so rapidly changing technological development is challenging industry actors to be dynamic and flexible in their operations. In a study conducted by the United Nations in 2018, over 50 percent of industry experts predicted that blockchain technology will have an impact on the maritime shipping industry within a near future. However, there is yet no consensus regarding how blockchain will impact the industry and what consequences such technology might bring for the industry participants. In order to investigate the potential effect of blockchain technology within a maritime shipping industry context, we are conducting a scenario planning analysis with insights from previous research as well as industry stakeholders. The final result will consist of a plausible description of how the industry future might unfold.

A short presentation of the interview procedure
A general introduction of the interviewee, their background and experience

The interview will approximately take 1 hour to conduct, and it is aimed at investigating your view on the maritime shipping industry and a potential application of blockchain. The interview discussions will be used in order to identify major trends within the industry as well as major uncertainties. Ultimately, these will be used in order to construct scenarios of future development within the industry. In total, 10 different actors consisting of industry or technology experts will be interviewed. The interview will be divided into two main parts where the first part concerns general discussion of the topic, and the later part will include more focused discussions.

- Do you wish to be anonymous?
- Do you wish for the company or organization that you represent to be anonymous?
- Is it okay for us to record this conversation?

Part 1

General questions regarding the industry and the application of blockchain

<u>Industry</u>

- Do you think there are any societal or economic trends that will affect the industry?
- What are the challenges within the maritime shipping industry?
- What are the opportunities within the maritime shipping industry?
- According to you, who are the most important stakeholders within the industry?
- Are there any processes or activities within the value chains that should or could be improved?

Blockchain

- What are the challenges with blockchain?
- What are the opportunities with blockchain?
- Does the challenges and opportunities differ between the different types of blockchain?
- Are you aware of any current or planned applications of blockchain within industries in general?
- Can you identify any current trends within blockchain?

Blockchain in maritime shipping

- What are your thoughts on the potential application of blockchain technology within the maritime shipping industry?
- Can you identify any opportunities with implementing blockchain within the industry?
- Can you identify any major challenges with implementing blockchain within the industry?
- According to you, what potential impact might blockchain have on industry actors within a maritime transport chain?

Part 2

This part of the interview will discuss the development factors or trends that you have mentioned in the discussions so far in more detail.

- Please motivate for the different factors' respective potential level of impact on the industry and the level of uncertainty in their outcome.
- Can you identify any additional major trends or uncertainties within the industry today?
- Can you identify any patterns of correlation or connections between the different applications?

Concluding questions

- Is there anything you would like to add?
- Would you like to take part of the final thesis when it is done?

Appendix 2 - Interview information

Investigating the potential role of Blockchain technology within the maritime shipping industry in five years

Background and introduction

The Maritime shipping industry is currently undergoing major changes where competition is fiercely increasing and the ever so rapidly changing technological development is challenging industry actors to be dynamic and flexible in their operations. In a study conducted by the United Nations in 2018, over 50 percent of industry experts predicted that blockchain technology will have an impact on the maritime shipping industry within a near future. However, there is yet no consensus regarding how blockchain will impact the industry and what consequences such technology might bring for the industry participants.

In order to investigate the potential effect of blockchain technology within a maritime shipping industry context, the authors of this report are conducting a scenario planning analysis with insights from previous research as well as industry stakeholders. The final result will consist of a plausible description of how the industry future might unfold.

The interview

Thank you so much for participating in this interview and helping us to move the research about the industry further. The interview is intended to be held within 60 minutes in either Swedish or English depending on your preference of choice. In addition to this, the choice to be anonymous is entirely up to you. No preparation is needed in order to participate in the interview but here are some general topics or questions that will be asked in order for you to get an overview of what will be discussed:

- Challenges and opportunities of blockchain
- Challenges and opportunities within the maritime shipping industry
- Potential application areas of blockchain within the maritime shipping industry
- The potential impact of blockchain within the maritime shipping industry

Let us know if you have any questions, otherwise we are thrilled you meet you soon!

Thanks and best regards,
Jenny Ytterström & Lisa Lenberg

Appendix 3 - Maritime shipping industry

Types of vessels

There are different types of vessels carrying cargo overseas. Some of the more common vessels are container vessels and roro vessels. The container vessels are specifically manufactured for transporting international standard containers of goods, and as new technology and improved operations have developed, the container vessels have improved in both speed and efficiency (Rushton et al., 2010). Roro vessels on the other hand are designed to enable cargo being rolled on the boat, most usually for transporting vehicles such as cars or rolling machines (ibid). Naturally, different designs on the vessels calls for different port requirements and terminal handling processes. All ports are not equipped or qualified to handle all types of goods or all types of vessels, there are also size restrictions that needs to be considered as the vessels vary majorly in size and weight (ibid). In order for the ports to stay truly competitive, they need to be able to adjust to the changing vessels (Stopford, 2008).

Value chains

A maritime shipping transport network involves several different actors. The three main parties in such a network are the carrier, the shipper and the port which all fulfil different purposes in moving cargo from one place to another (Talley, 2013). Specific maritime shipping routes are often operated by groups of shipping lines, companies that own and operate vessels in their fleets, and when these are grouped, they are within the industry called liner conferences (Rushton et al., 2010). As the shipping lines provide the physical element of the transport, i.e. the vessel itself, help is often needed from so called ship agents which provides different services to the shipping lines in terms of crew members, repair services, handling customs and documents and so on (ibid). One additional actor usually involved in maritime shipping processes are freight forwarders which are actors that oversee the entire transportation processes without being physically involved, they often provide full-aspect transport solutions to the customer and their part in the chain is to keep track of delays, changing routes and basically making sure that the cargo is transported from one place to another (ibid). The maritime transport value chain is illustrated below in figure 1.

The ports involved in maritime shipping processes can according to Stopford (2008) be divided into three different areas. The first area concerns the actual port, which Stopford (2008) argues to be the point where land and sea meet in a maritime transport chain, making it highly important as it functions as legal exchange points. The second area concerns the authority active within the port, meaning the organization that is responsible for providing service in terms of enabling the vessels to enter the port (ibid). Lastly, the third part concerns the terminal at the port which Stopford (2008) argues to be the areas within the port responsible for handling the cargo.

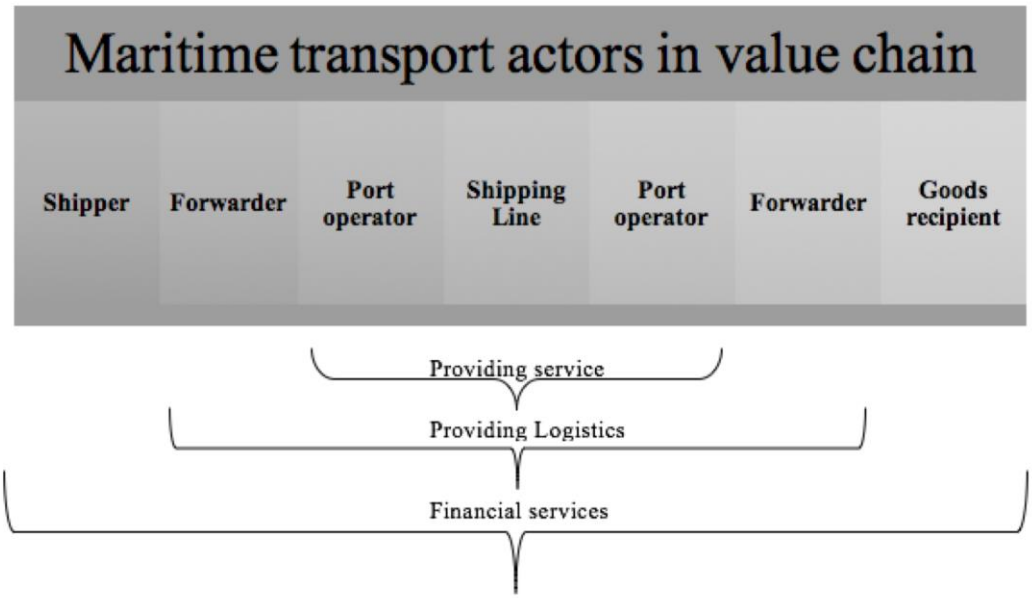

Figure 1: Maritime transport actors in value chain

Documentation

Bill of Lading (B/L): A bill of lading is a document functioning as a receipt of the cargo that is being transported, it is issued by the shipping line (or a line agent working for the shipping line) and states the destination to which the cargo is going to be delivered (Rushton et al., 2010). Even though the content may differ between different types of bill of ladings, the main characteristic is that the document states who is the legal bearer of the goods in transport (ibid).

Letter of credit (LC): A letter of credit is a document issued by a bank in order to ensure security in the financial aspect of the transport, meaning that it provides the legal boundaries where the buyer is ensured to receive the goods as specified by the buyer and the seller is ensured to receive the finances for the goods sold (Rushton et al., 2010).

Certificate of Origin (CO): A certificate of origin is often needed for the customs as different origins constitutes different trading tariffs, commercial invoices are documents specifying the characteristics of the goods sold and the cost, and finally the packing list entails details of the dimensions of the goods which often lies as the foundation for the transportation costs (Rushton et al., 2010).

Appendix 4 - The framing checklist

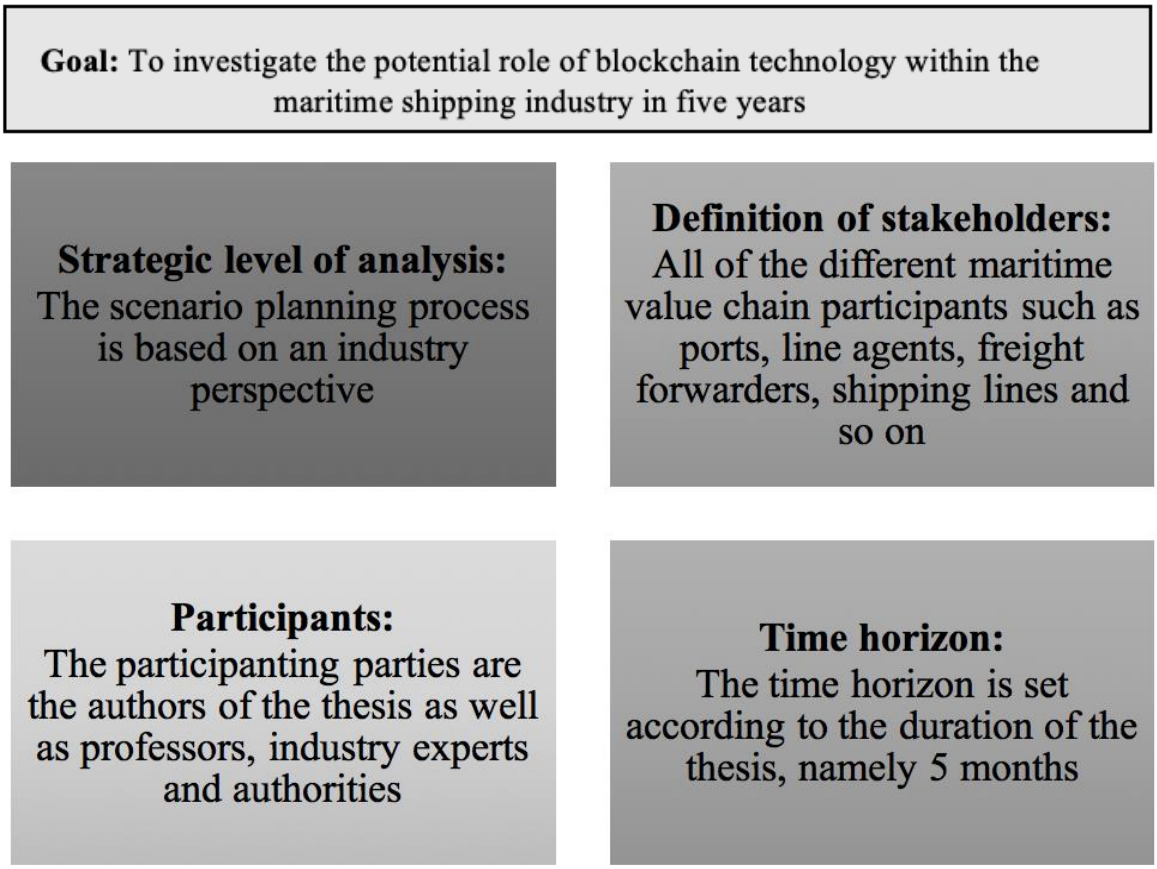

Figure 2: Illustration of framing checklist used in the first step of the scenario planning process