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Blockchain Technology in the Shipping Industry

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1 ABSTRACT

With the continuous growth of global trade, and more than 80% of this trade being transported by sea, shipping supply chains are increasingly both vital and complex. Despite this, the industry suffers from inconsistent flows of information due to flawed and outdated IT applications and information overlaps. After experiencing the inadequacy first hand, Maersk and IBM began a collaboration in order to create an industry-wide solution: A permissioned platform, TradeLens, using blockchain technology to ensure security, trustworthiness and real-time visibility. However, although Blockchain technology seems to be the solution the shipping industry has been waiting for, supply chain partners may be reluctant to join the platform. What is of interest in this study are the ways in which supply chain partners will benefit from the implementation of blockchain technology. More specifically, in what ways can the implementation of blockchain technology improve Agility, Adaptation and Alignment within shipping supply chains, create a synergy between the three, and thereby a sustainable competitive advantage? In order to answer this question, the study focused on the collaboration between Maersk and IBM and data was collected from secondary data sources in the form of online newspaper articles, as well as from interviews with relevant actors within the industry. The data was analyzed using the Triple-A framework as coding themes. There seemed to be a general consensus in the data, that the implementation of blockchain technology can in actual fact improve Agility, Adaptation and Alignment and create the necessary synergy to provide supply chain partners with a sustainable competitive advantage. However, there were certain elements that need to be in place. The most important is that each supply chain partner has the right technology in place. Also, a large majority of supply chain partners need to be onboard. Standardization and interoperability are vital, which, together with proof that the technology is viable, will help create the trust necessary for supply chain partners to move away from conventional IT and over to blockchain technology.

2 INTRODUCTION

2.1 BACKGROUND

Increasing globalisation, shorter life cycles of products and technologies, and global outsourcing are greatly increasing international trade. This increase in global trade is stimulating movements of cargo, international procurement, and new distribution strategies in multinational companies, and shipping companies play a main role in facilitating international trade through their involvement in the commerce and marketing of global trade, and by enabling the physical transport of cargo (Yang, 2016). With increasing preference for door-to-door services, maritime logistics organisations have been prompted to accept responsibility for transporting container cargoes door-to-door and to assume increased supply chain management functions. In turn, maritime logistics are being redefined and proving that a distribution channel with reliable global transport coverage is essential (Seo et al., 2015). More than $4 trillion in goods are shipped each year and, according to the IMO (2008), maritime transport carries 90% of global trade volume. Also, it has been estimated that the maximum cost of the required trade documentation to process and administer many of these goods is one-fifth of the actual physical transportation costs (IBM press release, 2018). Optimizing the supply chain relies heavily on the performance of transport providers in the coordination of such things as equipment, terminal handling, freight rates, follow-up and a high level of information technology (IT) (Papadopoulou et al., 2010), and as such supply chain partners exert great pressure on container shipping providers. Because of this pressure, as well as due to developments in IT, the adoption of IT applications has been a popular way of streamlining transport services and storing information (Tseng & Liao, 2015). However, the international shipping industry's conventional IT systems have relied on legal documents, with electronic data being transmitted via electronic data interchange (EDI), a 60-year-old technology that doesn't represent real-time data information (Mearian, 2018). As such, the shipping supply

chains have become increasingly inefficient. In 2016, Maersk tracked a test container shipment from Mombasa to Rotterdam, and calculated that the cost of moving the container was approximately $2000 of which approximately $300 was paperwork. In other words between 15% and 20% of the total cost of shipping the container (Longman, 2017). Also, the shipment went through more than 30 people and organizations, with more than 200 different communications between them (Chavez-Dreyfuss, 2017). The shipping industry is therefore increasingly looking to blockchain technology for solutions. Through its distributed ledger technology, blockchain technology is now seen as a way of digitising the litany of paper documents, such as bills of lading, letters of credit, contracts of sale, and charter agreement contracts, which have defined maritime transactions until now. Blockchain is a database, or ledger, that tracks transactions, hosted across many nodes and cryptographically guarded from fraud. Using blockchain technology to, for example, manage freight tracking makes sense due to the many parties and the high levels of risk involved in shipping supply chains (Morris, 2017). Using blockchain technology would also enable the exchange of supply chain transactions and documents in real time, minimize the time products spend in the shipping and transit process, improve inventory management, and, ultimately, reduce waste and cost (Chavez-Dreyfuss, 2017). It would reduce barriers in international supply chains which would, according to The World Economic Forum, increase global trade by nearly 15 percent. Also, because no one party can modify, delete, or even append, any record without the consensus from others on the network, the level of transparency helps to reduce fraud and errors (Hunt, 2017). It is believed by Maersk that the implementation of blockchain technology has the potential to make massive, scalable savings (Longman, 2017). In his Maersk press release, Churchill states that, since 2014, Maersk has been collaborating with IBM in order to implement blockchain technology, which has culminated in the industry-wide solution called TradeLens, a platform targeted at removing costs, speeding up the processing of goods, eliminating theft and adding much transparency to the shipping industry (Murphy, 2018).

Maersk and IBM aim to get rid of all paperwork thereby making the process of shipping containers smoother and faster, and allowing all partners to keep track of goods and be able to check where the shipment is at any point (Moon, 2017). "Working closely with Maersk for years, we've long understood the challenges facing the supply chain and logistics industry and quickly recognized the opportunity for blockchain to provide massive savings when used broadly across the ocean shipping industry ecosystem", said Bridget van Kralingen, Senior Vice President of Industry Platforms at IBM (Chavez-Dreyfuss, 2017). "We are excited about this cooperation and its potential to bring substantial efficiency and productivity gains to global supply chains, while decreasing fraud and increasing security," said Ibrahim Gokcen, soon to be former Chief Digital Officer at Maersk. "We expect the solutions we are working on will not only reduce the cost of goods for consumers, but also make global trade more accessible to a much larger number of players from both emerging and developed countries'" (Hunt, 2017). With TradeLens, Maersk and IBM aim to connect all the different partners in the global supply chain in one secure digital platform where information can be shared and used, while also leveraging the data in order to develop products for the customers in the industry. When discussing this ongoing collaboration between Maersk and IBM, Vincent Clerc, Executive Vice President and Chief Commercial Officer at Maersk says that the platform "marks a milestone in our strategic efforts to drive the digitization of global trade. The potential for offering a neutral, open, digital platform for safe and easy ways of exchanging information is huge and all players across the supply chain stand to benefit" (Churchill, 2018).

2.2 Research Focus

The global expansion in the growth of trade, the heavy reliance on shipping to transport this trade, the intricacies and complexities of shipping supply chains, together with conventional IT systems that are becoming outdated, increasingly highlight the need for a

more efficient, contemporary and cutting-edge system. The shipping industry is showing a lot of enthusiasm for blockchain technology. This can be witnessed in the increasing amounts of pilot studies being conducted in the industry and especially the abovementioned ongoing collaboration between Maersk and IBM and the creation of their industry wide blockchain platform, TradeLens. There seems to be strong faith within a majority of the shipping industry that blockchain technology can bring about the changes needed to improve what has become an outdated and untrustworthy system, as well as a much needed streamlining of the supply chain. But can blockchain technology provide the benefits that the industry believes it can provide? What is of interest in this study is the ways in which blockchain technology can benefit the supply chain partners and help them gain a sustainable competitive advantage.

2.3 Research Value

Although shipping supply chains are highly complex, little focus has been placed on the integration of these supply chains. According to Tseng and Liao (2015), even though the shipping industry faces both supply uncertainty and an acceleration in customer service demand due to the often turbulent competitive global economy and the dynamic environment in which it operates, studies in this area are scarce. Also, blockchain technology is a very new and novel topic. As such, very few academic articles have been written on the subject, especially on the use of blockchain technology in the shipping industry. As a result, there is a lot of hype surrounding the technology but little concrete knowledge, and many supply chain partners may be unsure about the benefits they can gain from implementing blockchain technology. The importance of this study is in understanding the ways that blockchain can improve the supply chains in the shipping industry and in turn provide supply chain partners with a sustainable competitive advantage. Also of value in this study is the use of the Triple-A framework (Lee, 2004), a

framework which has also been used by Gunasekaran et al. (2017) to analyze the implementation of conventional IT in the shipping industry but has not been used to analyze the implementation of blockchain technology in the shipping industry.

2.4 Research Objective

The research draws on the concepts of Agility, Adaptation and Alignment from Lee's (2004) Triple-A framework, a synergy between which he posits is necessary in order for a company to go beyond a competitive advantage and gain a sustainable competitive advantage. More specifically, how can the use of blockchain technology help container shipping companies satisfy Lee's Triple-A framework in order to gain this sustainable competitive advantage? The research question therefore is:

"Can blockchain technology improve the supply chains in the shipping industry and help supply chain partners gain a sustainable competitive advantage?"

In order to gain insight into the ways blockchain technology can help to better integrate the supply chain, interviews are conducted with relevant players at both Maersk and IBM, as well as within the industry, with particular focus, as much as possible, on the ongoing collaboration between Maersk and IBM. Data is collected from secondary data in the form of online newspaper articles discussing this topic. All the data is uploaded to NVivo and coded according to the Lee's (2004) Triple-A framework.

2.5 Research Structure

This research paper is structured as follows. Chapter 3 contains an overview of blockchain technology, as well as the ways that it can benefit business. Chapter 4 briefly explains the complexities of container shipping supply chains. It goes on to discuss the existing

literature on supply chain integration, and the ways with which SCI and IT implementation affect performance. Chapter 4 also introduces the Triple-A framework presented by Lee (2004), as well as a summary of the ways that conventional IT implementation and Triple-A synergy can benefit container shipping, as presented by Gunasekaran et al. (2017). The Triple-A framework is operationalized in the final section of chapter 4. Chapter 5 is the methodology and discusses how the research is conducted and why it is conducted that way, followed by the limitations to the research method. Chapter 6, the empirical analysis, presents and analyzes the data acquired using the Triple-A framework. Chapter 7 concludes the study and as such summarizes the results, and discusses the contributions, limitations of, and reflections on, the study.

3 BLOCKCHAIN

With all this discussion in the media about blockchain and its many benefits, the questions arise: What exactly is blockchain technology, what are the benefits of blockchain technology implementation to business, and how can it benefit the supply chains of the container shipping industry? These questions will be answered in the following sections.

3.1 BITCOIN: THE BEGINNINGS OF BLOCKCHAIN TECHNOLOGY

In 2008, perhaps in response to the global financial crisis, the pseudonymous group or individual called Satoshi Nakamoto published a white paper outlining a new protocol. This new protocol introduced a peer-to-peer electronic cash system using a digital currency, or cryptocurrency, named Bitcoin. Unlike with fiat currencies, Bitcoin (and cryptocurrencies in general) are neither created nor controlled by countries. Also, it is straight forward, relying on basic constructs such as hash functions and digital signatures, as well as on

cryptographic proof. Transactions are signed and distributed on a public network, allowing irreversible transactions sent directly between peers. Moreover, because of this form of distributed computations, this protocol establishes rules ensuring the integrity of the data exchanged amongst the billions of computers in the distributed network without the need to go through a third party. Bitcoin, and cryptocurrencies in general, are not stored in one file somewhere, but are represented by transactions recorded on a type of global spreadsheet or ledger. This distributed ledger is what is known as a blockchain. Blockchain draws on a large distributed network to verify and approve each transaction. Basically it is "a 'Trust Protocol': a trustworthy global platform for transactions" (Tapscott & Tapscott, 2016)(P:6). Unlike previous cryptocurrency proposals, the protocol is not only workable but can be scaled to a large number of computers called nodes, and open-sourcing the implementation is an excellent call to developers to maintain and support the growth of the system (Karame, 2016). What's more, the software is built on a publicly-accessible transaction ledger, distributed and validated by a network of independent nodes. What is more important, the design is powerfully resilient to attacks. This is because the solution proposed by Satoshi relies on cryptographic proof. In other words, transactions are signed and distributed on a public network, allowing irreversible transactions sent directly between peers without a centralized authority (Caetano, 2015).

3.2 How Does Blockchain Technology Work?

Transactions made are grouped into blocks which are then shared and validated by a network of computers on the network known as nodes. The blocks are accepted through consensus on the network (Caetano, 2015). As each additional block is added to the network, known as a ledger, the blockchain is extended, and, as such, it represents a complete ledger of transaction history (Nofer et al., 2017). There can only ever exist one canonical ledger. This is because every computer in the network downloads its own copy

of the identical ledger from the other computers in the network, and, as such, the blockchain is everywhere. As transactions are added to the network, the network is updated and the information is bounced to all the other computers. Altering approved blocks is virtually impossible. If anyone attempts to alter a previous block, they have to redo all the signatures from that block forward and, as such, that blockchain would no longer match the other copies distributed in the network. Also, not only is the blockcain constantly updated, but the current block would also have to be solved (Karame, 2016). Blocks are cryptographically validated, each block is timestamped, and each block contains both the hash value of the previous parent block and a nonce, which is a random number used to verify the hash. The hash values are unique, and any changes in the blockchain immediately change the respective hash value. The hash value, the timestamp and the nonce ensure the integrity of the entire block (Nofer et al., 2017). The blockchain is able to record and validate millions of transactions, and once the transactions are validated by the network, they are irreversible and impossible to change or alter (Caetano, 2015).

A digital signature is used to sign a transaction. This digital signature can only be generated by the holder of a private key, and is used by the network to verify that the transaction was created by someone with access to the private key. Without this verification, the transaction would be rejected by the network, and therefore from the public ledger. Once the transaction is signed it is ready and broadcast to the network for confirmation. Each node holds a copy of the ledger and has access to all transactions from the beginning. The node's job is to register new transactions and send them to the other nodes in the network. Some of these nodes are what is called miners. These miners perform computational work to ensure that each transaction is valid, and each miner must then prove their results to the other miners. If there are any discrepencies, the miner's results will be rejected by the network. Miners also have a cryptographic puzzle to solve, known as proof-of-work. Proof of work is a difficult yet feasible mathematical calculation necessary to legitimize a block of transactions. Therefore, the larger the network of miners

with consensus, the more the ledger can be trusted (Caetano, 2015). As well as the complicated signing and hashing serving to lock each block to the next in the chain, the cumulative effect of the proof-of-work helps the network maintain an identical chain. The software will always choose the longest blockchain, because this blockchain will have the largest amount of computers and therefore computer power, working on it. This is because, the more blocks on the chain, and therfore the more transactions, the longer the hashes and therefore the more difficult the proof-of-work. There is only ever a single blockchain, and it is the one used by the majority of the network (Karame, 2016). The whole process mentioned above makes the blockchain both resilient and trustworthy.

3.3 Benefits of Blockchain for Business

Using blockchain technology to transfer cryptocurrency is one thing, but how can it benefit business? One of the reasons why Blockchain is interesting for business is when considering public keys and digital signatures and the security that they bring. Using a digital signature proves that a document is an exact copy and that it has not been modified or forged. This is because the digital signatures rely on a set of keys: a public key and a private key. Each user has their set of keys: a public key used to encrypt messages, and a private key to decrypt them. Because the public key is used to generate a private key using an assymmetric cryptographic algorithm, and because these two keys are mathematically bound, the two keys are forever linked together. When signing a document with a private key, therefore, a signature is created that can be verified by the associated public key. The public key can therefore not be interchanged with another key. In other words, the public key only functions with its corresponding private key. The public key can be sent to the receiver, and because it can only be generated by the private key, the receiver can verify the sender. The sender signs the document with the private key and the signature is included in the document (Caetano, 2015).

Another reason why blockchain technology is interesting for business is because a decentralized ledger is also useful in handling different types of information, from business contracts or private financial records to sensitive medical records. Those working directly with the technology are realizing the many other things that it can be used for. Santander bank is praising blockchain technology for its ability to handle contracts between partners in the supply chain, and instead of interfacing between different accounting systems and wholesalers and shippers, a single blockchain could track materials and product shipments between any number of companies (Karame, 2016).

There are many other benefits to using blockchain technology in business. There are time savings: Not only are transaction times reduced from days to minutes, but transaction settlement is also a lot faster because it does not have to go through a central authority. There are cost savings: Less oversight is needed because the network is self-policed by participants; items can be exchanged directly between participants so intermediaries are reduced; and, because all participants have access to the same ledger, the duplication of effort is eliminated. There is tighter security: Because of the security characteristics of blockchain technology there is protection from tampering, fraud and cybercrime. There is enhanced security: Through the use of IDs and permissions, participants can decide which details they want other participants to see. There is improved auditability: Monitoring and auditing become a lot easier when a shared ledger serves as a single source of truth. Last there is improved operational efficiency: Because transfers of ownership are streamlined with the use of blockchain, business transactions can be conducted at a speed more in line with the pace of doing business (Gupta, 2018).

Permissioned blockchains, which is what TradeLens uses, have added benefits. A permissioned blockchain is an unchangeable, highly secure and trusted shared network, where all participants are known, have permission to participate, and have end-to-end visibility (Groenfeldt, 2017). A major benefit to business that permissioned blockchains

bring is the trust that they build. This is due to five attributes: First, the ledger is distributed and sustainable. This means that it is shared and updated with each transaction and copied to all participants in near real time. Second, its existence does not depend on one single entity because it is not controlled by a single organization. The ledger is secure, private and indelible. This means that permissions and cryptography prevent unauthorised access to the network and ensure that participants are who they say they are. Third, the ledger is transparent and auditable. This means that, because the participants in a transaction have access to the same records, they can validate transactions and verify ownership and identities without the need for third-party intermediaries. Also, because transactions are timestamped, they can be verified in near real time. Fourth, the ledger is consensus-based and transactional. This means that all the network participants must agree upon the validity of a transaction, which is done through the use of consensus algorithms. Last, the ledger is orchestrated and flexible. This means that, because business rules and smart contracts can be built into the blockchain platform, business networks can evolve as they mature to support end-to-end business processes and a wide range of other activities (Gupta, 2018) According to a press release by IBM (2018), advocates believe that permissioned blockchain technology as a platform for data sharing fits well with the structure of global supply chains. By ensuring the abovementioned security and trustworthiness, the permissioned blockchain enables unprecedented collaboration as well as trust between supply chain partners. It will allow particpants to go to one place to track the real-time status of containers as well as access to up-to-date and trustworthy trade information. Through its authentication process, distributed information and unalterable transaction records, blockchain technology provides immutability as well as real-time end-to-end visibility, in turn allowing supply chain partners to manage their supply chains securely, and seamlessly exchange information while allowing the creation of new and more efficient shipping processes. Paperwork filings will be automated and digitized, and end users will be able to securely submit, validate and approve documents throughout the supply chain,

ultimately reducing the time and cost for the clearance and movement of cargo (IBM press release, 2018).

As stated above, the benefits of implementing blockchain technology are many. The question is how blockchain technology can improve supply chain integration (SCI) in the shipping industry. The next section will discuss the complexities of supply chains in the shipping industry. It will then go into depth in the literature surrounding SCI in general, and the benefits of combining SCI with conventional IT implementation. Following this will be an overview of the Triple-A theory as presented by Lee (2004) as well as the ways that the implementation of conventional IT together with a synergy between the Triple-A framework can create a sustainable competitive advantage as presented by Gunasekaran et al., (2017).

4 LITERATURE REVIEW AND THEORY

The following chapter provides a review of the overall literature on SCI. First, there will be a discussion of supply chains in the shipping industry as a way of highlighting the greater complexities of shipping supply chains compared to regular supply chains. Second, the existing literature on SCI will be reviewed, and will inform on the factors considered necessary for improved SCI. This is followed by a section outlining the ways with which greater SCI improves firm performance, and, last, a section going into depth about SCI and IT implementation in the shipping industry.

4.1 The Complexities of Container Shipping Supply Chains

As mentioned previously, maritime transport has gained a crucial role in the global economy and maritime supply chains now involve a network of shippers, freight

forwarders, shipping carriers, port logistics service providers, and agents who perform various value-added activities to add value for consumers (consignees). According to Tseng and Liao (2015), the global container shipping industry is an important actor in the enhancement of international trade in merchandise and unfinished goods, and the development of maritime logistics has been facilitated by global trade liberalization. Although a shipping supply chain is essentially a logistics supply chain, it is a more complex and integrated system consisting of all the activities necessary to deliver containers to customers, including inventory, transportation, packing, container storage, container loading, container trans-shipment, container unloading and unpacking, distribution, cargo, shipping agencies, and customer service. The container supply chain also differs from the logistics supply chain in its cost structure. Whereas logistics generally only considers supply costs, the container supply chain considers shortage costs, transportation costs, handling costs, storing costs, and overstock costs. Because the container supply chain delivers and increases value to the entire chain, the integration and collaboration between all the nodes in the network are essential (He et al., 2015). According to Midoro et al. (2005), cooperation within, and integration of, the supply chain are becoming more critical than competition in determining efficiency. Moreover, maritime logistics organisations such as terminal operators, shipping lines, in-land transport companies, freight forwarders, ship management companies and third-party logistics providers, have been prompted to accept responsibility for transporting container cargoes and to assume increased supply chain management functions (Seo et al., 2015). In spite of this, Seo et al. (2015) and Lam (2015) share the opinion that SCI, or what they term supply chain collaboration, is insufficiently developed both academically and practically. Lam (2015) concludes that, despite its significance in the global economy, not many studies have been undertaken to address SCI in maritime transport. This is surprising for various reasons. First, partner integration, such as with a terminal operator, can greatly affect the organizational performance of container shipping and is therefore an important issue. Second, because

of its global service characteristics, the environment of container shipping is a lot more complex than that of manufacturing. Third, due to the turbulent and competitive global economy in which it operates, the container shipping industry faces both uncertainty of supply as well as acceleration in customer service demand. Fourth, because customers demand a greater selection of global services, and because shipping firms are vital in satisfying the requirements from shippers and consignees by effectively deploying fleets and selecting ports, a better integrated container shipping service is necessary. Also, when constructing global supply chains, manufacturers and traders depend on an effective maritime supply chain to integrate cargo and information flows. Container shipping companies need to make strategic efforts to be competitive in their supply chain in order to reduce logistics costs and satisfy the needs of customers. For the above reasons therefore, the partnerships within the maritime industry have become important (Tseng & Liao, 2015).

As evidenced, successful SCI is becoming a vital and integral part of the shipping industry, but what exactly is SCI? The literature discussing SCI will addressed in the following section.

4.2 Supply Chain Integration

SCI has become an increasingly prominent research stream in operations and supply chain management. Despite this, and although the basic concept of integration has been familiar to researchers, there has previously been no clear or widely accepted definition of the concept and conceptualizations. For this reason, operationalizations have varied greatly (Pagell, 2004). Fabbe-Costes and Jahre (2008) state that, as a result of this lack of a single formal and clear definition of SCI, the finding of practical solutions determining what to integrate, the costs, and the benefits of integration are difficult. According to Zailani and Rajagopal (2005), SCI refers to the network of all the elements, such as suppliers,

customers and companies, involved in the supply chain. Lambert et al. (1998) and Cooper et al. (1997) define SCI as the "integration of key business processes from end users through original suppliers that provide products, services and information that add value for customers and other stakeholders" (Tseng & Liao, 2015)(P:84). Cooper et al. (1997) also state that strategic, tactical and operational perspectives typically need to be considered in the development of SCI. For Chen et al. (2009), SCI is a broad term that spans different tangible and intangible elements of organizations' operations, both internally and externally, to develop efficiencies in their supply chains. As can be seen, there seems to be an overall convergence amongst scholars of the definitions of SCI, but how can SCI be operationalized and what are the chracteristics of successful SCI? This will be discussed in the following section.

There seems to be a general consensus amongst scholars that the characteristics necessary for the operationalization of SCI, as well as efficiency amongst the partners in the supply chain, are supply chain coordination (Jayaram et al., 2011) and supply chain collaboration (Sanders and Premus, 2005; Vereecke and Muylle, 2006). Chen et al. (2009) see SCI as deliberate interactions a firm takes to achieve operational and strategic efficiencies. These interactions are done through collaboration, commitment and coordination with other firms in order to jointly achieve objectives, commonly supported by information sharing and open communication. SCI enables firms to attain a competitive edge by streamlining business processes and by coordinating activities with business partners. Rodrigues et al. (2004) and Stank et al. (2001) also highlight the importance of collaboration describing integration as the goal of the firm to achieve operational and strategic efficiencies through collaboration among its internal functions as well as with other firms. Stank et al. (2001) posit that increased collaboration among supply chain partners results in lower costs and better service performance. More specifically, collaboration should begin with customers and extend back through the firm, from finished goods distribution and raw material

procurement, as well as to material and service suppliers. In other words, both internal (intraorganizational) and external (interorganizational) integration are needed.

Internal integration refers to "the cross-functional intra-firm collaboration and information sharing activities that occur via interconnected and synchronized processes and systems" (Schoenherr & Swink, 2012)(P:100). As such, internal integration measures relate to collaboration between the different functions of an organization, such as operations, logistics, and marketing and sales in order to accomplish supply chain objectives.

External integration, in turn, focuses, on a broad level, on inter-firm aspects and therefore focuses on the breadth and depth of relationships that firms maintain with their upstream and downstream business partners. Upstream integration with suppliers and downstream integration with customers are considered to be the main elements of external integration (Frohlich and Westbrook, 2001; Devaraj et al., 2007; Flynn et al., 2010). Bowersox et al. (1999) define integration as "a collaborative-based strategy to link interorganizational business operations to achieve a shared market opportunity" (Stank et al., 2001)(P:30).

Supplier integration refers to "coordination and information sharing activities with key suppliers that provide the firm with insights into suppliers' processes, capabilities and constraints, ultimately enabling more effective planning and forecasting, product and process design, and transaction management" (Schoenherr & Swink, 2012)(P: 100), and thus aides a firm in tightly integrating the supply base with internal operations and external demand. In essence, supplier integration helps a firm to tightly integrate the supply base with internal operations and external demand (Ataseven & Nair, 2017). Ragatz et al. (1997) recognize that successful integration of suppliers into the supply chain is a key factor for manufacturers in achieving the improvements needed to remain competitive, and Tan et al. (1998) state that, "when all strategic partners in the chain 'integrate' and act as a single entity, performance is enhanced throughout the chain" (Tan et al., 1998)(P:3).

Customer integration represents "close collaboration and information sharing activities with key customers that provide the firm with strategic insights into market expectations and opportunities, ultimately enabling a more efficient and effective response to customer needs" (Schoenherr & Swink, 2015)(P:100). It therefore addresses the firm's collaboration and coordination endeavors on the demand side.

The literature concludes that coordination and collaboration between supply chain partners is essential for successful SCI. The importance of internal integration, as well as external integration upstream with suppliers and downstream with customers have also been highlighted. How, though, does SCI affect firm performance? This will be addressed in the following section.

4.3 SCI AND PERFORMANCE

With the increasing convergence of definitions on SCI, and how it can best be achieved, the question has arisen as to the actual effect SCI has on firm performance. Since the mid-1990s, authors such as Ragatz et al. (1997), Frohlich and Westbrook (2001), Stank et al. (2001), Dröge et al. (2004), Lee (2004), Swink et al. (2005), Cousins and Menguc (2006), Vereecke and Muylle (2006), Devaraj et al. (2007) and Schoenherr and Swink (2012), have not only examined the strategic aspect of SCI, but also empirically investigated the relationships between different dimensions of the supply chain and various performance measures. They found that, to varying yet positive degrees, greater SCI leads to improved firm performance (Schoenherr & Swink, 2012). Wu (2009) also found that SCI has a positive influence on performance outcomes (Wu, 2009). Frohlich & Westbrook (2001) highlight the importance of internal integration within the firm, as well as external integration with suppliers and customers, in their 'arc of integration' framework, a framework based on a global sample of 322 manufacturers. When classifying integration strategies, this 'arc of integration' framework represents the direction and the degree of internal integration, as

well as external integration upstream with suppliers and downstream with customers. They find consistent evidence that the firms with the broadest 'arc of integration' with both suppliers and customers have the strongest association with performance improvement, and that the most successful manufacturers seem to be those that carefully link their internal processes to external suppliers and customers in unique supply chains. This view is supported by many other scholars, such as Stevens (1989), Lee et al. (1997), Metters (1997), Narasimhan and Jayaram (1998). Lummus et al. (1998), Hines et al. (1998), and Johnson (1999). What all these scholars agree on is the need to share operational activities, and therefore in which direction (towards customers and/or towards suppliers) and to what extent (degree of integration) such shared activity should be developed (Frohlich & Westbrook, 2001). Ragatz et al. (1997) and Lee (2004), have also emphasized integration with suppliers and customers to be a key competitive differentiator. In other words, firms that integrate and act as a single entity enhance performance throughout the supply chain (Tan, 1998). Flynn et al. (2010) studied the relationship between customer, supplier and internal integration on operational and business performance, and found that internal and customer integration were more strongly related to improving performance than supplier integration. However, supplier integration is important to performance only as part of the interaction term (Flynn et al., 2010). There is, however, a general consensus between scholars, that both collaboration and cooperation between supply chain partners is vital in SCI, and also that the firms with the broadest 'arc of integration' upstream with suppliers and downstream with customers generally witness improved performance. The above studies have focused on manufacturing. Tseng and Liao (2015), more specifically, study the ways that greater SCI, as well as conventional IT implementation, improves performance in the shipping industry. Their findings will be discussed in the following section.

4.4 The Effects of Supply Chain Integration & IT on Shipping

So, as mentioned above, SCI generally has a positive effect on firm performance, but although studies, such as those above and those by Baghi et al. (2005), Fabbes-Costes et al. (2009) and Jayaraman & Tan (2010) have proposed frameworks for SCI, these studies have mostly focused on manufacturing and logistics. These industries, however, depend on effective maritime supply chains in order to integrate cargo and information flows, and therefore partnerships within the maritime industry have become increasingly important (Tseng & Lin, 2011). When discussing SCI in shipping, Esper and Williams (2003) find a positive association between cooperation and logistics service performance within shippers and carriers, and also that increased collaboration between shippers and carriers leads to reduced transaction costs and risks, improved service performance, and a more streamlined supply chain. The shipping industry needs to make strategic efforts to be competitive by lowering logistics costs and satisfying customers (Lam, 2011; Lam & Voorde, 2011), and integrated supply chains provide operational visibility and a streamlined flow of goods that compress the time interval between a customer's request for a service and its delivery (Hult et al., 2004). However, Wanger and Frankel (2000) found that interorganizational relationships are not enough to secure a competitive advantage and enhance performance (Wanger and Frankel, 2000), and Tseng and Liao (2015), highlight the importance of market orientation when discussing SCI and firm performance.

4.4.1 Market Orientation

Market orientation has seldom been discussed in studies on shipping services, even though it plays a key role in the container shipping industry, especially under conditions of dynamic and fierce competition. Kohli and Jaworski (1990), define market orientation as "the organization wide generation of market intelligence pertaining to current and future customer needs, dissemination of the intelligence across departments, and organization wide responsiveness to it" (Kohli & Jaworski, 1990)(P:6). Market orientation emphasizes

the ability of a firm to learn about customers and competitors in order to more clearly determine the best responses to retain or attract customers. A market-oriented firm will produce and store market information that is needed to build, maintain and enhance a systems approach to cooperative relationships with other supply chain partners. According to Wilmsmeier and Notteboom (2009), because container shipping is becoming increasingly market driven, the supply chain integration should also be market oriented in order to effectively respond to customer demands. A market-oriented organization collects, shares and answers market knowledge with inter-functional coordination in order to access customer needs and competitor information. Recent studies, such as those by Kim (2009) and Morgan et al. (2009), have pointed to a positive link between market orientation and various firm performance variables, such as profitability, market size, market share and growth rate. Min et al. (2007) find market orientation to have a strong, positive impact on supply chain orientation and supply chain management. The study indicates the positive effect of market orientation on firm performance. (Tseng & Liao, 2015).

Of importance for market orientation is the efficient dissemination of information in order to effectively compete in a competitive maritime market (Payanides, 2006). Highly market-oriented firms will typically try to collect timely information about the market environment and include it in their decision making, leading to cooperation and alliances among partners, departments and customers, and the initiation of future resource integration. Also, timely container information enables firms to more efficiently coordinate business processes with supply chain partners, and react flexibly to customer needs. Having access to up-to-date information enables shipping companies to stay ahead of competitors, and therefore, container shipping companies must continuously stay in touch with their customers, competitors, other stakeholders, and the environment in which they operate, so that they can respond quickly to any market turbulence (Tseng & Liao, 2015).

4.4.2 The Benefits of IT Implementation on SCI and Market Orientation

The access to timely information highlights the importance of IT application. This is in line with earlier studies, such as by Day (1999) and Min et al. (2002), which show that IT application has a positive effect on market orientation and that technology adoption is, as such, an essential condition for success that needs to be an ally to market orientation. According to studies by, for example, Lun et al. (2008), Makris et al. (2008) and Wong et al. (2009), IT has become increasingly common in the shipping industry, in part due to institutional pressure from supply chain partners. Increased IT implementation has many benefits for maritime shipping. Internet connection provides online transaction services, market information services, support services, and performance and equipment information. Overby et al. (2006), found evidence that using increasingly high levels of IT applications, such as internet-based technologies and e-commerce, directly affect market activities as well as enhance firm market orientation strategies in container shipping lines. Along the same lines, Stank et al. (1999) and Day (1999) have highlighted the importance of IT applications in the collection of market information, and also in the promotion of market orientation strategies of firms in terms of intelligence dissemination and responsiveness. This helps to explain why the firms that adopt various web site services and information technologies are better at understanding customer preferences and adapt their service attributes in order to respond to sudden changes in the market environment and customer needs. Min et al. (2002) reported that internet technologies are able to transform a traditional market orientation into a more efficient and effective one and that the internet is vital for gathering information on environmental changes, for sharing information and knowledge, for developing market focussed responses, and for supporting market orientation behavior. Recent advances in IT applications and implementation greatly enhance the dissemination of information in the maritime market, and allows for the more efficient movement of messages and the fostering of a greater degree of seamlessness in transport services. It also enables many stakeholders to, not

only to keep track of the market, but also to look for the best offer and fix the best available contract (Alizadeh and Nomikos, 2002). Angeles (2009) found that IT application reduces IT complexities and enables a firm to optimize global supply chain strategies as a way of maximizing performance outcomes. Wong et al. (2009) found that trading firms that adopted IT-enabled transport logistics could improve cost performance, especially when faced with environmental uncertainty. Lambrou et al. (2008) and Lun and Quaddus (2011) found that the implementation of IT in supply chains enables a firm to gather and store data about its customers, suppliers and market demands, which, in turn, influences firm performance. According to Li et al. (2009), IT application is arguably an essential ingredient for business survival and creates a seamless integration of entities in a supply chain because it helps firms to transmit and process necessary information for synchronous decision making. Nikitakos and Lambrou (2007) indicated that information communication technology (ICT) is becoming increasingly important for efficient and timely container processing throughout the shipping value-chain. ICT adoption facilitates quicker access to information, improved communication between supply chain partners, reduced operation costs and better service quality. Tongzon et al. (2009) reported that investing in advanced IT in shipping lines reduces turnaround time for ships, which in turn is passed on to shippers in terms of lower freight rates. As such, a firm can use the IT application to manage its own container supply chain while also allowing it to offer high-quality services to its customers. Moreover, the automatic exchange of information helps maritime supply chain partners to become better informed and allows them to make earlier decisions (Lambrou et al., 2008). (Tseng & Liao, 2015)

Tseng and Liao (2015) find that there were significant benefits in container flow management when adopting technology services, which is in line with a container transport study by Venus Lun et al. (2008), and highlight that IT application indirectly improves firm performance via SCI. This suggests that container shipping companies can use IT applications for such things as information exchange, arrangement of port callings, or

electronic document handling with supply chain partners. This would not only increase the efficiency of container flow but also result in a reduction of response time of the supply chain. These benefits can be shared between the partners in the electronic operation environment. Tseng and Liao also found no direct effect of IT application on firm performance, although Dehning and Stratopoulos (2003) did find a non-significant direct relationship. This finding implies that cost is important in determining the decisions of container shipping companies when considering investment in advanced IT equipment, and also suggests that the firms have not fully utilized the advantages offered by IT applications. In summarizing their findings, Tseng and Liao (2015) find that IT application does not directly improve firm performance. However, IT implementation positively affects market orientation and SCI, and and since market orientation and SCI positively influence firm performance, IT implementation can be said to indirectly influence firm performance. (Tseng & Liao, 2015)

According to Tseng & Lios, these findings have three main implications for shipping companies. As mentioned, they find a positive association between SCI and firm performance, and as such they suggest that shipping companies need to develop strategic collaboration with their supply chain partners in order to maintain reliable services and enhance performance. They also highlight the importance of IT in the dissemination of market and customer information, and as such, they must make substantial investments in logistics. The results also indicate that market orientation leads to SCI as well as having a major influence on firm performance, which not only highlights the importance of being prompt in the response to customer requirements but also the collection of market information with which to respond to market and competitor changes. Last, even though IT application had a positive effect on both market orientation and SCI and an indirect effect on firm performance through SCI, IT application was not found to have a direct influence on firm performance. This suggests that real-time information and feedback should be provided to departments, partners and customers via an information platform,

and also that online transaction records can supply useful information and aide in recalling customers' characteristics and preferences.

In short, Tseng & Liao (2015) conclude that firm performance can be improved through greater SCI and market orientation, which in turn rely on information dissemination as well as timely information, which can both be greatly improved through IT implementation.

Within the literature discussed above, there is a general consensus that the key characteristics necessary to improve firm performance and create a competitive advantage are greater SCI, and as such, greater collaboration and cooperation between supply chain partners, and greater market orientation. Lee (2004) agrees with, and builds on, the above in his Triple-A framework, a clear set of guidelines for creating a sustainable competitive advantage. Although geared at manufacturing, Lee posits that the factors necessary to foster integration among supply chain partners are information sharing and collaboration, joint decision making and coordination, all factors that not only help to align the interests of the partners in the supply chain and but also aide in improving the overall performance of the supply chain as opposed to maximizing only internal efficiencies of individual firms (Ataseven & Nair, 2017). More specifically, in his Triple-A framework Lee discusses the need for a synergy between Agility, Adaptation and Alignment in order to gain a sustainable competitive advantage. This Triple-A framework will be summarized in the following section.

5 THE TRIPLE-A FRAMEWORK

5.1 LEE'S TRIPLE-A SUPPLY CHAIN

In an article published in the Harvard Business Review in 2004, Hau L. Lee presented his Triple-A framework. Having worked with over 60 leading companies focused on building

and rebuilding their supply chains to deliver goods and services to consumers as quickly and inexpensively as possible allowed Lee to study these companies from the inside. It occurred to Lee that becoming more efficient in cost and speed, previously considered to be the holy grails of supply chain management, was not adequate in securing a sustainable competitive advantage. Previously, when business was booming, management would aim at speed maximization, and when the economy slowed, firms would try to minimize costs. Also, Lee observed that even companies with efficient and cost-effective supply chains did not gain a sustainable advantage over their competitors, and in some cases, actually had a steadily deteriorating supply chain performance. Even those firms that invested in state-of-the art technologies, hired top-notch talent to boost supply chain performance, teamed up to streamline processes, laid down technical standards, or invested in infrastructure they could share, did not manage to gain a sustainable advantage over rivals. Lee asked himself why efficient supply chains, in his words, hadn't been able to 'deliver the goods' and came up with several reasons. High-speed, low-cost supply chains are unable to respond to unexpected changes in demand or supply; many companies have centralized manufacturing and distribution facilities to generate scale economies; and many companies deliver only container loads of products to customers in order to minimize transportation time, freight costs, and the number of deliveries. Lee concluded that in order to build a sustainable competitive advantage it is necessary for a company to implement what he coined a Triple-A framework. In other words, a company must be Agile, and react speedily to sudden changes in demand and supply. The company must Adapt over time as market structures and strategies evolve, and, last, they must Align their interests with those of the other firms in the supply chain so that companies optimize the chain's performance when maximizing their own interests. (Lee, 2004)

5.1.1 AGILITY

Lee says that for a company to be Agile they "respond quickly to sudden changes in supply and demand", they must "handle unexpected external disruptions smoothly and cost

efficiently", and they must "recover promptly from shocks such as natural disasters, epidemics, and computer viruses". In short the objective of Agility is to 'respond to short-term changes in supply and demand quickly' (Lee, 2004)(Page 1).

Agility is vital because in most industries, both demand and supply fluctuate more quickly and widely than previously, and sudden shocks to supply chains have become frequent. Most supply chains cope by playing speed against cost. Agile ones, however, respond both quickly and cost-efficiently. Without a doubt, agile supply chains recover quickly from sudden setbacks (Lee, 2004).

Companies can build more agile supply chains by following certain guidelines. They can continuously provide data to their partners about supply and demand so that their partners can respond quickly, and they can collaborate with suppliers and customers so that companies work together in the design and redesign of processes, components, and products, as well as in the preparation of back-up plans. Ensuring that there are no information delays is the first step in creating an agile supply chain. Also, they can design products so that they share common parts and processes, differing only substantially in the end of the production process. They can keep a small inventory of inexpensive, non-bulky components that are often the cause of bottlenecks, and they can build a dependable logistics system, either alone or through alliances with third-party logistics providers, which will enable the company to regroup quickly in response to unexpected needs. Last, they can create a team that knows how to invoke back-up plans and design products so that they share common parts and processes initially and differ substantially only by the end of the production process. (Lee, 2004)

5.1.2 Adaptation

Lee says that for a company to be Adaptable, they must "evolve over time as economic progress, political shifts, demogaphic trends, and technological advances reshape

markets". In short, the objective of Adaptability is to "adjust supply chain design to accommodate market changes" (Lee, 2004)(Page 1).

Successful companies don't stick to the same supply networks when markets or strategies change. Adaptation can be tough, but it's critical in developing a supply chain that delivers a sustainable advantage. Most companies are not aware that, besides unexpected changes in supply and demand, supply chains are also faced with changes in markets, shifts that can occur due to economic progress, political and social change, demographic trends, and/or technological advances. Unless companies adapt their supply chains, they won't stay competitive for long. The most successful supply chains are able to recognize structural shifts, sometimes before they occur, by capturing the latest data, filtering out noise, and tracking key patterns, and then, accordingly, relocating facilities, changing suppliers, and when possible, outsourcing manufacturing (Lee, 2004).

In order to build an adaptable supply chain two key components are required. The first is the ability to identify future trends. This can be done by tracking economic changes, especially in developing countries, because, as competition is becoming increasingly global, the costs, skills and risks to global supply chain operations change. They can also decipher the needs of the ultimate- and not just immediate- consumers so as not to suffer the bullwhip effect, which amplifies and distorts demand fluctuations. At the same time, companies must retain the option to alter supply chains, and in order to do this they must develop new suppliers that complement existing ones, and they must ensure that product design teams are aware of the supply chain implications of their designs. (Lee, 2004)

5.1.3 ALIGNMENT

Lee says that for a company to be Aligned, they must "align the interests of all participating firms in the supply chain with their own so that, as each player 'maximizes its own interests, it optimizes the chain's performance as well". In short, the objective of Alignment is to

"establish incentives for supply chain partners to improve performance of the entire chain" (Lee, 2004)(Page 1).

This is critical because every firm tries to maximize its own interests, and misaligned interests can cause problems, even if the supply chain partners are divisions of the same company. A way in which firms can align their own interests with those of their partners is by redefining the terms of their relationships, so that all the firms in the supply chain share risks, costs, and rewards in an equal and fair manner. This can be done, first, with the alignment of information, so that all partners in the supply chain have access to the same forecasts, sales data, and plans. Then they must align identities, which means that they must redefine the roles and responsibilities of each partner so that there is no scope for conflict. Companies must also align incentives so that, when a firm tries to maximize returns, they also maximize those of the supply chain. This can be done by trying to predict the behavior of supply chain partners in light of their current incentives. Incentives must be redefined so that partners act in ways that are closer to what's best for the entire supply chain. Sometimes the process of alignment involves the use of intermediaries. (Lee, 2004)

Most firms already have the infrastructure in place to create Triple-A supply chains, but what they also need is a new culture and attitude in order to get their supply chains to deliver Triple-A performance. Companies must relinquish the counterproductive efficiency mind-set, must be prepared to continuously change networks, and take responsibility for the entire chain instead of only looking out for their interests alone. This can be a challenge for companies because no technologies exist that can do those things and therefore only managers can make them happen. In Lee's own words, "the best supply chains aren't just fast and cost-effective. They are also Agile and Adaptable, and they ensure that all their companies' interests stay Aligned" (Lee, 2004)(P:2). More specifically, Lee (2000) specifies that the concept of information integration is about increasing visibility along the supply chain and enables connectivity between processes (Lee, 2004).

The Triple-A framework presented by Lee is geared towards manufacturing, and there are therefore certain aspects of the framework that are not relevant for shipping. Gunasekaran et al. (2017) take this framework and apply it to the implementation of information technology (IT). This will be discussed in the following section.

5.2 Triple-A and the Use of IT

In response to the lack of clarity surrounding the extent to which the implementation of conventional IT contributes to competitive advantage within logistics and supply chains, Gunasekaran et al. (2017) provide a systematic review of the literature by using the Triple-A framework mentioned above to conceptualize the use of IT within logistics and supply chains in order to achieve a competitive advantage. Their research is therefore informed by the following questions: Does IT enable supply chains: "(i) To rapidly respond to short-term changes in supply and demand- that is, to be agile?" "(ii) To accommodate market changes- that is, to become more adaptable?" and "(iii) To incentivize supply chain partners to improve the supply chain- that is, to be aligned?" (Gunasekaran et al, 2017)(P:15) In order to answer these questions, Gunasekaran et al. (2017) systematically reviewed the literature on this subject from 2004 to 2014, and by using the concepts of Adaptation, Alignment, and Agility as a way of determining the role of IT in achieving a sustainable competitive advantage within logistics and supply chains. Their literature review is deemed highly reliable for the following reasons. The period from 2004 to 2014 is chosen because Gunasekaran and Ngai had previously provided a review of the literature on the subject up to 2004, and also because they felt that this time frame was particularly representative of the research on the role of IT within logistics and supply chains. Because the literature list covered the majority of highly-ranked journals in the field at the time, it is deemed adequately comprehensive by the authors, and therefore able to provide

reasonable insights into the level of influence of IT in achieving sustainable competitive advantage through the implementation of Agility, Adaptation and Alignment. Last they felt that their choice in the Triple-A framework was not only relevant for their research but also reflected the views of scholars in the field at the time. (Gunasekaran et al., 2017)

Although this literature review discusses the use of conventional IT, and not blockchain technology, what is of interest here is the use of the Triple-A framework in the analysis, and the conclusions drawn from the literature.

What are considered to have been the benefits to logistic and supply chains from the implementation of conventional IT? According to the literature, the use of IT has resulted in benefits such as increased efficiency and responsiveness by revolutionizing traditional logistics and supply chains. According to Lee (1997), the internet has effectively resolved the tradeoffs between internal and external, upstream and downstream, integration, and allowed the types of integration necessary between every partner in the supply chain. Previously, real-time information and inventory visibility were impossible, but now web-based technologies have become increasingly indispensable for forecasting, planning, scheduling and execution. Real-time information travels immediately backwards though supply chains, while inventory information flows swiftly forwards. The delivery of goods and services when and where they are needed is now quicker and more reliable, and, with the flow of data between customers and suppliers becoming more integrated, it has become easier it to balance supply and demand across the network, and, in turn, greater online coordination with associated reduced lead times helps defeat the bullwhip effect and contributes to higher performance (Lee et al., 1997). Despite this, and even though there has been enormous pressure from supply chain challenges and practioners' expectations in terms of achieving competitive advantage through the use of IT solutions, the literature on IT and Triple-A has mostly underlined the importance of IT for value creation and business performance; the role of resource commitment and IT resources on

performance; and has suggested that IT can be explored and exploited for supply chain innovation (Boulesnane & Bouzidi, 2013) and to obtain a distinctive supply chain advantage (Fawcett et al., 2011). Also, there has seemingly been a gap in the literature on IT and its effect on supply chains and performance. Scholars have cautiously investigated the role of IT since the key publication by Garr in 2003 in which he suggested that IT alone was not able to create strategic value due to the wide availability and affordability of data storage, data processing and data transport. Scholars such as Coltman and Devinney (2013) and Coltman et al. (2011) have since suggested that IT is only likely to generate value when combined with organizational and human resources (Gunasekaran et al., 2017). Also, Fosso-Wamba et al. (2015) recently suggested that even though there is wide acknowledgement of the business value of IT within supply chains, much remains unknown and scholars such as Grover and Kohli (2012) and Wang et al. (2012) have stated that the role of IT within supply chains continues to be one of the key issues among academics and practitioners.

It remains unclear to what degree the use of IT has contributes to competitive advantage. Based on their review, Gunasekaran et al. (2017) argue that the achievement of competitive advantage in supply chains through IT is based on the ability of organizations to utilize IT strategically and synergistically to achieve Alignment, Adaptability, and Agility (Gunasekaran et al., 2017). More specifically, they asked the following questions: Does IT enable supply chains to be more Agile, in other words, to rapidly respond to short-term changes in demand or supply? Does IT enable supply chains to become more Adaptable, in other words, to accommodate market changes? Last, does IT enable supply chains to be better Aligned, in other words, to incentivize supply chain partners to improve the supply chain?

In conclusion, and in answer to the above questions, Gunasekaran et al. (2017) posit that those firms that build their IT capabilities without the synergy of these three attributes may

still gain competitive advantage, although it will be short-lived and therefore not a sustainable competitive advantage. It is therefore important that managers implement all three in order to not be overtaken by rivals. It is also important to consider the particular technological competences that reside within the firm, together with its organizational and supply chain goals (Gunasekaran and Kobu, 2007; Gunasekaran et al., 2015a, 2015b). The underlying human and organizational factors that influence the use of IT as a strategic resource to achieve competitive advantage may result in challenges (Bharadwaj et al., 2007; Rai et al., 2006) because different organizational strategies can have an impact on which technology is used and how. Therefore, stakeholder participation is needed for supply chain and IT strategy formulation, so that they align with stakeholder goals (Sheu, 2011). Managers should therefore understand and further explore the different attributes of the competitive elements of supply chain and logistics when deciding on the use of IT to achieve competitive advantage. (Gunasekaran et al., 2017)

The authors suggest areas of possible future research, some of which are of interest to this study. Specifically, they mention that their review revealed that the studies on IT Agility are scarce compared to studies on IT Alignment and Adaptation. They therefore call for more studies (both quantitative and qualitative, cross-sectional and longitudinal) to further investigate the role of IT in Agility. Also, their conceptualization of the literature could be further developed by conducting interviews with practitioners in order to understand the role of IT within supply chains, and more specifically, measure supply chain Agility, Adaptation and Alignment. Comparing and contrasting the findings with their review conceptualization would provide further insights and help to develop an holistic overview of the role of IT in three-As within supply chains to achieve sustainable competitive advantage. (Gunasekaran et al., 2017)

5.3 Operationalization of the Triple-A Framework

With the use of their thourough literature review, Gunasekaran et al. (2017) have concluded that, in order to gain a sustainable competitive advantage over competitors with the use of IT implementation, it is necessary to create a synergy between Adaptation, Agility and Alignment. What is of interest for this paper now is to determine whether the use of blockchain technology will help firms to gain a sustainable competitive advantage by satisfying the Triple-A framework and finding a synergy between the three. In parallel with, and complimenting, the Triple-A framework, I will also draw on the article by Tseng and Liao (2015) in which they discuss the importance of market orientation and IT application in improving performance and achieving a sustainable competitive advantage. This article is also important because it specifically discusses the container shipping industry. Lee's Triple-A framework was geared mostly towards industries such as manufacturing, and therefore some of the guidelines presented by him are not of relevance to container shipping. For this reason and because I am considering the use of IT to gain a sustainable competitive advantage in container shipping and not in, for example, manufacturing, I have taken only the points from Adaptation, Alignment and Agility that are relevant to container shipping. I will consider Agility, Adaptation and Alignment in turn, pulling on the central points of Tseng and Liao (2015).

The main points to consider from Agility within the supply chain are the ability to adjust to changing needs and to adapt the supply chain accordingly. This can be done by collaboration and the provision of data throughout the supply chain. It is vital that there are no information delays and that a reliable logistics system is in place. When considering market orientation and IT application as presented by Tseng and Liao (2015), the following points should be highlighted. IT-enabled logistics leads to improved cost performance, which is especially vital during environmental uncertainty. Having access to up-to-date information allows shipping companies to stay ahead of their competitors, and they must

therefore continuously stay in touch with their supply chain partners and the environment in which they operate, in order to quickly respond to any market turbulence. It also allows them to research how best to attract and retain customers. It is important to produce and store market information about past transport records as well as arrange and predict future container flows, which are also greatly facilitated by IT application. Information communication technology (ICT), more specifically, allows for the sharing of information and knowledge, quicker access to information and improved communication among supply chain partners. With an automatic exchange of information, maritime supply chain partners become better informed, which in turn allows them to make earlier decisions. All these points help the shipping industry develop market focused responses and support market oriented behavior and ensure efficient and timely container processing. As can be concluded from the above, both market orientation and IT application can aide the container shipping firm in becoming more Agile and thereby respond more efficiently to shocks and fluctuations.

According to Lee (2004), when considering Adaptation of the supply chain, the importance is the ability to evolve over time in response to economic progress, political shifts, demogaphic trends, and technological advances that reshape markets. This is in line with market orientation and IT application as presented by Tseng and Liao (2015), who mention the gathering of market intelligence through inter-functional coordination. As mentioned previously, market orientation is "the organization wide generation of market intelligence pertaining to current and future customer needs" (Kohli and Jaworski, 1990)(P:6). IT application can be used to arrange and predict future container flows, allowing the maritime supply chain partners to adapt accordingly. The application of IT allows the supply chain partners to gather and store information about suppliers, customers, as well as market supply and demand. ICT, as mentioned before, allows the supply chain partners to quickly access information, improves communication between them and, with automatic exchange of information, makes them better informed and more capable of making early

decisions, developing market focused responses and supporting market oriented behavior. All these points allow the container shipping partners to respond efficiently to changes in markets.

The main point of Alignment is incentivising the supply chain partners to share risks and costs, but also rewards, which can be done through the alignment of information, identities, and incentives. Here, as in Agility and when considering market orientation, coordination is important for the supply chain partners so that they can collect market intelligence. A highly market oriented firm will gather and store timely market information necessary to create, maintain and strengthen a systematic approach to cooperation with their supply chain partners. IT application facilitates the collection of information on past records and aides the partners to arrange and predict container flows. It also allows for reduced turnaround time for ships which in turn lower freight costs, and therefore benefits the entire supply chain. What is of importance here is quick access to information, better communication throughout the supply chain, reduced operation costs and better service quality. Combining market orientation and IT application, therefore, can benefit the entire supply chain and together they can make the supply chain more aligned.

As proposed by Lee (2004) and concluded by Gunasekaran et al. (2017), therefore, in order to achieve a sustainable competitive advantage over competitors, it is necessary for firms to find a synergy between Agility, Adaptation and Alignment when applying IT. The guidelines proposed by Tseng and Liao (2015) that span all three are the use of IT for the the gathering of data on customers, suppliers and demand; for the development of forecasts; and for the storage of market information, in turn allowing for efficient and timely container processing. The emphasis on coordination, improved communication, and faster access to information is also highlighted.

For this research paper, interviews were conducted with representatives from both Maersk and IBM with a focus on the pilot study which they conducted at the beginning of 2017,

as well as their ongoing collaboration. When taking into consideration the abovementioned Triple-A and guidelines, the interview questions were divided into three areas of focus: Agility, Adaptation and Alignment and synergy between the three. There were also some introductory questions and as well conluding questions concerning the interview respondents' overall opinions of the advantages and disadvantages of the implementation of blockchain technology in the shipping industry. For the interview guides, please see Appendices 2 and 3.

6 METHODOLOGY

The following chapter considers the research philosophy used, pragmatism, and explains why this research philosophy is appropriate for this study. Sections 6.2 explains how the theory develops, deductive to inductive, and section 6.3 explains what type of research it is, which is loosely a case study. This is followed by a section about how the research was conducted and data acquired, describing in depth details such as who was interviewed, and which prior documents were sent. The last section discusses the limitations to the research.

6.1 RESEARCH PHILOSOPHY: PRAGMATISM

This dissertation follows a pragmatism approach. Morgan (2014) says that the focus of pragmatism is not only on how the research is being done, but also the reasons why it is being done that way, turning it from abstract concerns to an emphasis on human experience. As such, pragmatism "concentrates on beliefs that are more directly connected to actions" instead of framing research as an "abstract set of philosophical beliefs# (Morgan, 2014)(P:1050) and sees reality "not as a static phenomenon, but

constantly in the making" (Keleman & Rumens, 2008) (P:41). This focus on action-based knowledge acquirement is echoed by Pihlström (1998, P:83) who said: "we act in a world and acquire knowledge about the world on the basis of our action". More specifically, pragmatism "strives to reconcile both objectivism and subjectivism, facts and values, accurate and rigorous knowledge and different contextualized experiences" by "considering theories, concepts, ideas, hypotheses and research findings not in an abstract form, but in terms of the roles they play as instruments of thought and action, and in terms of the practical consequences and specific contexts" (Saunders, 2016)(P:143). As stated by Morgan (2014), "there may be an affinity between paradigms and methods, but there is no deterministic link that forces the use of a particular paradigm with a particular set of methods" (Morgan, 2014)(P:1) In that sense, pragmatism can serve as a research philosophy, regardless of whether the research is qualitative, quantitative or mixed methods, and moves away from the older research philosophies that emphasize research in terms of ontology, epistomology and methodology. Pragmatism also aims to reconcile "subjectivism and objectivism, facts and values, accurate and rigorous knowledge and different contextualized experiences" by "considering theories, concepts, ideas, hypotheses and research findings, not in an abstract form, but in terms of the roles they play as instruments of thought and action, and in terms of their practical consequences in specific contexts". Of importance for pragmatism is the 'freedom of enquiry" (Morgan, 2014)(P: 1050)'. In other words, pragmatism is not narrowly defined by any specific research philosophy, nor is it a narrow research philosophy. What is important is satisfying the research aim in the best way possible, and as such, it is up to the researcher to determine the issues that are most important and further pursue these issues in ways that are most meaningful to them. Although this study does not support action as is typical for traditional pragmatism, what is important in this study is the research problem being addressed and the research question, which in turn shape the research design and strategy. Blockchain technology is in many ways in its infancy, few people work directly

with the technology, and academic data sources on the topic are few. As a result, gathering sufficient data was difficult. It was therefore not possible to follow a very rigid research philosophy, and resulting rigid research strategy. Due to the nature of the research aim and question, and due to the lack of a wealth of knowledge of any particular type in the area of blockchain technology in the shipping industry, a multi-method data collection is applied, as this is deemed the most adequate in enabling "credible, well founded, reliable and relevant data to be collected that advance the research" (Keleman & Rumens, 2008)(P:41). As such, this dissertation follows a pragmatism approach.

6.2 Theory Development

With its use of Lee's (2004) Triple-A framework, the research starts from a theoretical perspective, so deductively, thereby helping to get the research started by linking the research to any previous body of knowledge in the field of study, by providing an initial framework for analysis, and by organizing and directing the data analysis. This is done by using the Triple-A framework to not only formulate the research question and objectives, but also to formulate the interview guide to be used during the interviews. The Triple-A framework was also used to analyze the data. Although the study is theory-driven in the beginning, and hence begins deductively, the main body is inductive and as such theory was used to analyze the data and not to test hypotheses. This is partly because a deductive approach would be too restrictive in relation to issues revealed in the data, and partly because it could fail to allow the meanings expressed by the research participants to be explored adequately. Also, the focus is to understand the ways in which blockchain technology can help companies create a sustainable competitive advantage through the development of a synergy between Agility, Adaptation and Alignment in their supply chains. As such, the study aims at acquiring a greater understanding of what is going on, and making sense of the data collected. Also, as well as answering the research question,

the result of the analysis is the formulation of an updated Triple-A theory specifically considering the use of blockchain in shipping.

6.3 RESEARCH DESIGN

According to Flick (2014), a case study is not studied to only make statements about a concrete case, but rather is studied because it is "a typical or particularly instructive example of a more general problem" (Flick, 2014)(P:122) and case studies are therefore selected in order to allow more general conclusions to be drawn. For Yin (2014), a case study is "an empirical inquiry that investigates a contemporary phenomenon within its real-life context, when the boundaries between the phenomenon and the context are not clearly evident, and in which multiple sources of evidence are used" (Eriksen & Kovalainen, 2016)(P:132). Eriksen & Kovalainen (2016) see case studies as a great way of using multiple sources of data to generate both holistic and contextual in-depth knowledge. Also, they see no limits to the empirical data used in a case study. Rather, what is of importance is that the data collected satisfies the aim of the study. The focus of this dissertation is primarily on the collaboration between Maersk and IBM which can be seen as an instructive example of the implementation of blockchain technology, and an adequate example from which to draw conclusions. Also, empirical data was drawn from both interviews and secondary data in the form of online newspaper articles, and as such multiple sources of evidence were used. As the abovementioned guidelines are mostly satisfied, it can be said that this dissertation is, in a loose sense, a case study. However, only 8 interviews were conducted of which 3 were with representatives from Maersk, 3 were with representatives from IBM. Because of this, and also because the subject is so new, it was not possible to collect adequate in-depth data with which to do an in depth case study. However, multiple perspectives of the ways that the implementation of blockchain technology can create the synergy between the Triple-A framework were collected from both Maersk and IBM. Also,

although they mostly converged, there were different perspectives within the same organizations which allowed for depth of perspective. In case study research, predefined propositions are used to develop a thematic coding scheme which is then used when collecting and analyzing the data. As such the codes are derived from theory (Eriksen & Kovalainen, 216)(P:141). As such, with the use of the Triple-A theory from the beginning, the study conducted a thematic analysis. By drawing on the Triple-A theoretical framework presented by Lee (2004), as mentioned in section 4.5, this study is driven by a theoretical interest and as such is a theoretical thematic analysis. According to Flick (2014), thematic analysis is "a method for identifying, analyzing and reporting patterns (themes) within data. It minimally organizes and describes your data set in (rich) detail. However, frequently it goes futher than this, and interprets various aspects of the research topic" (Braun & Clarke, 2006)(P:79) This Triple-A framework has allowed the generation of predefined definitions, those of Agility, Adaptation and Alignment, which are the basis for a predeveloped thematic coding scheme with which to conduct a thematic analysis. As the interview guides were based on the Triple-A framework, this coding scheme has also helped in the collection and analysis of empirical data.

Although the subject of blockchain technology is very current, there exist few academic articles on blockchain, and few people work directly with this technology, let alone have conducted a pilot study using blockchain. For this reason, a multi-method approach was used in which data were drawn from interviews and online newspaper articles. This in turn allowed for the different perspectives on Blockchain technology to be studied and analyzed in order to answer the research question. A benefit of using a multi-method approach to data collection is that it enables triangulation, "a combination of different methods… in dealing with a phenomenon" (Flick, 2014)(P:122). In other words, the cross-checking of content. Also, because of the lack of accessible data, a quantitative analysis was deemed unrealistic. Therefore the research is a qualitative data analysis. This study's aim was to determine in what ways Blockchain technology can help a shipping company

achieve a sustainable competitive advantage through their supply chains. As such, this study is an assessment of the effectiveness of using Blockchain technology and therefore evaluative. The interviews were conducted from February to May, 2018. Because of this and because of the fact that Blockchain technology is very new and constantly evolving, the study is considered cross-sectional.

6.4 Research strategy

The Copenhagen Business School library data base as well as Google Scholar were initially searched for any academic articles and/or books about Blockchain in general. Quite a few books and some articles were found. However, there was nothing on the use of Blockchain technology in shipping. Therefore a search was made on both Blockchain and Blockchain in shipping using Google. Many online articles were found. The Maersk and IBM websites were also consulted. Because no academic articles were found on the subject of the use of Blockchain technology in shipping, and in order to not depend solely on online journalistic articles, it was deemed necessary to conduct interviews with relevant actors in the field having worked, or working directly, with Blockchain technology. As the pilot study conducted by Maersk and IBM, as well as the ongoing collaboration between the two, is the case in focus in this study, it was decided that potential interviewees should be sourced, as best possible, from these two companies.

Maersk was initially contacted via their central number in Denmark in the hope of being put in contact with any relevant actors working directly with, or having knowledge of Blockchain technology. However, the receptionist was unsure who to put me in touch with and therefore no contacts were gained using that avenue. A list was then compiled using LinkedIn of any individuals working at Maersk and seeming to be in a position or department that would be working with, or having knowledge of, Blockchain technology. Before consulting this list, IBM was contacted, in view of the current Blockchain-based joint

venture between IBM and Maersk. This was in part to find potential interviewees with knowledge of Blockchain, and in part as a way to gain access to Maersk through IBM.

André Goude, a Business Development Specialist at IBM Nordic was sent an email, as well as a follow up email. Unfortunately he did not respond. André Greve, Director of the Delivery Optimization Office at IBM Denmark, was also emailed a request. He was unable to grant an interview but, speaking on the phone, he said he would try to put me in contact with colleagues at IBM that could help me. He did not contact me although follow up emails were sent. Eva Dorn-Jensen, Client Executive at Maersk, was sent an email request, as well as follow up emails. Although she was unable to help, she placed me in contact with Irtaza Hussain, Senior Strategy Consultant in the Global Trade Digitisation department at IBM Global Business Strategy, who kindly agreed to an interview. Also, Hans Peter Dueholm, Nordic CTO at IBM, and Jan B. Lillelund, CTO at IBM Denmark, were sent email requests. All were sent a copy of the introduction, as it was at that time (see Appendix 1), as well as the initial interview guide (see Appendix 2). Three interviews were conducted with participants from IBM. Having no direct contact with representatives at Maersk concerning Blockchain, Hans Peter Dueholm was unable to put me in contact with potential interviewees at Maersk. Jan Lillelund was also unwilling to put me in contact with representatives at Maersk claiming that it was a need-to-know basis. Irtaza Hussain, however, put me in contact with a colleague, Amir Esfanjani, Consultant in the Cognitive Process Transformation department at IBM Global Business Services. He was unwilling to help as he stated that supply chains was not his specialty. When these avenues were all closed, the previously mentioned list was consulted, and interview requests were sent to potential interviewees at Maersk.

As mentioned previously, the list of potential interviewees at Maersk was compiled, and those that seemed in positions most relevant were contacted. This was done by email in order to be able to attach a shortened and more simplified interview guide (see Appendix

3), as well as a brief overview of the Triple-A theory used in this study (see Appendix 4), and the email addresses were based on the typical Maersk email address template. Craig Scott, Head of Operations IT at Maersk Line; Peter Steen Olesen, Head of Supply Chain at Maersk Line; Adam Norup in the Fleet Management and Technology department at Maersk Line; and Adam Banks, Chief Information Officer at Maersk, were all sent interview requests as well as follow up emails but did not reply. Dexter Buenaventura, EDI Coordinator at Maersk Line, is currently working in Dubai but was able to put me in touch with Hans Rasmussen at the Regulatory EDI department at Maersk Line. However, he was unable to provide an interview stating that it was not within his expertise. Markus Kuhn, Head of the Category Management Office at Maersk Procurement Marine, did not feel he was the right person not working directly with Blockchain, and he could not put me in contact with anyone. James Berian, Head of Data Science at Maersk Line could not help directly, although he suggested I contact Lorenzo Setale and Simon Kiilerich Vedel. And interview request had already been sent to Lorenzo Setale, as well as follow up emails, and although one email was received in which he apologized for not responding, and even after more follow up emails, he did not contact me again. Simon Kiilerich Vedel was able to grant an interview. He also put me in touch with Helen Belshaw, Process Design Manager at Global Trade Digitisation, also with whom an interview was conducted. She placed me in touch with Daniel Wilson, Commercial Manager in the Global Trade Digitization department at Maersk, who, unfortunately did not have time as his efforts were fully committed to the IBM/Maersk joint initiative. Lars W. Lorenzen, Onboarding Manager at Maersk Line's Global Trade Digitization, was also unable to help stating that he was maybe not the person to talk to. However, he did put me in touch with Henrik Hvid Jensen, Product Manager at Maersk's Global Trade Division, who kindly granted an interview. He, in turn, suggested I speak with Thomas Jensen, Assistant Professor at the Department of Digitization at Copenhagen Business School, and with whom he had collaborated with on the pilot study conducted by Maersk to track flowers from Kenya to Holland. Thomas

Jensen also kindly granted an interview. Thomas Jensen suggested Roman Beck, Professor at the Business IT department at the IT University of Copenhagen and Head of the European Blockchain Center, as a potential interviewee. Unfortunately he stopped giving interviews for Bachelor and Master Students two years ago due to time constraints and excess interview requests. He suggested some articles to read but was unable to put me in contact with anyone further. At this stage it was decided that no other potential candidates would be contacted in order to continue with the study.

Last, knowing that the DMA (Danish Maritime Authority), or Søfartsstyrelsen in Danish, were interested in using Blockchain technology in the Ship's Registry, a call was placed to their central number requesting an interview, after which I was put in contact with Rasmus Axelsen, Special Consultant in the Ship's Registry. After a brief conversation on the telephone during which I gave a brief summary of my research aims, a written email request was sent to which an overview of the Triple-A theory in English (see Appendix 4) was attached. He in turn put me in touch with Morten Brix Laursen, Head of Danish Cyber Security at DMA. Both agreed to a joint telephone interview in Danish, after which a shorter interview guide was sent in Danish (see Appendix 5).

Two interviews, with Irtaza Hussain (see Appendix 6) and with Rasmus Axelsen and Morten Brix Laursen (see Appendix 7), were conducted over the telephone. Two interviews, with Jan B. Lillelund (see Appendix 9) and Hans Peter Dueholm (see Appendix 9), were at IBM in Holte. One interview, with Thomas Jensen (see Appendix 12), was at the Department of Digitization at Copenhagen Business School. Three interviews, with Simon Kiilerich Vedel (see Appendix 13), Helen Belshaw (see Appendix 14) and Henrik Hvid Jensen (see Appendix 15), were at the Maersk offices at Pier47. This was in order for the interviewees to feel comfortable in their surroundings and in order to not waste their time any more than necessary. All those contacted were guaranteed the signing of a confidentiality agreement if they should so desire. All those who granted an interview declined. Most

interviewees gave an hour of their time maximum, although some interviews were shorter than the allotted time.

All interviewees were asked whether it was possible to record the interviews. All consented making note-taking unnecessary and allowing full attention on behalf of the interviewer.

All interviewees were asked if it was possible to conduct the interview in English. Six interviews were in English. Two interviews were in Danish: the interview with Rasmus Axelsen and Morten Brix Laursen at DMA and the interview with Jan Lillelund at IBM Denmark. Both have been translated into English (see Appendix 8 and Appendix 10).

A copy of the introduction (see Appendix 1) as well as the initial interview guide (see Appendix 2) were sent to Hans Peter Dueholm, Jan B. Lillelund, Irtaza Hussain and Amir Esfanjani. However, while conducting the interviews at IBM, it became apparent that the copy of the introduction and the initial interview guide had not been read, perhaps due to time constraints. Also, the interview questions seemed too long during the interviews. All those contacted thereafter were therefore sent a shorter and more simplified version of the interview guide (see Appendix 3) as well as a brief overview of the Triple-A theory used in this study (see Appendix 4). However, it was still deemed necessary to give a brief verbal overview of the theory prior to the interview.

The interviews conducted were all semi-structured as a means of encouraging natural expression. Also, the interviews were open-ended, asking the opinions of the interviewees of the advantages and disadvantages of Blockchain technology in general. This was a way of allowing the interviewees to give more information and mention anything they perhaps felt they had left out from their previous responses.

The interviews conducted were all transcribed, and those interviews conducted in Danish were translated into English and transcribed. These transcripts, as well as all online newspaper articles found concerning the collaboration between Maersk and IBM and their

implementation of Blockchain technology were all uploaded to the NVivo program in order to be coded. The data was then coded under the clsasification nodes of Agility, Adaptation and Alignment.

Once the data was collected, it was uploaded to NVivo and coded in order to identify themes and patterns relating to the research question. This type of analysis allows for a systematic approach to analyzing qualitative data. However, it is also flexible in that it is not tied to any particular research philosophy, and it can be used whether an objectivist or subjectivist position or inductive or deductive approach are adopted, all aspects that fit with the pragmatism research philosophy mentioned above. Thematic analysis is appropriate for both large and small data sets. The interviews conducted were transcribed into NVivo. Although time consuming, it allowed for greater familiarization of the data, which in turn allowed for recognition of meanings, recurring themes and patterns in the data, all of which were important elements in the analysis of the data. The NVivo program allowed for ease in the categorization of data with similar meanings, and allowed for easier accessibility for further analysis as well as easier rearrangement and retrieval of relevant codes. Because the study begins deductively, in other words with the prior use of the Triple-A theory, it began with a framework of codes derived from this theory. According to Saunders (2016), because the research question is based on this theory, this was adequate in its analysis of the data.

6.5 Limitations

In total it was only possible to conduct 8 interviews. However, the data necessary to conduct the analysis could be drawn from these interviews together with the online newspaper articles. Although online newspaper articles and blogs can be highly subjective, the information presented is relevant, reliable and up-to-date. Also, a large quantity were

used for data collection. This provided sufficient data to make the empirical analysis while also allowing for triangulation of the data.

Another limitation with the interviews was the inexperience of the interviewer, who could maybe have gained more information by being able to better probe the interview respondents for more details. However, with the information acquired from the interviews as well as from the secondary data, adequate data was collected for the empirical analsysis of this dissertation.

Another limitation is the fact that the focus is mostly on the collaboration between Maersk and IBM. It could perhaps have provided a more rich wealth of data if the research had been conducted for the whole Danish maritime industry, or the global shipping industry. However, there are few that have conducted pilot studies making use of Blockchain technology, to date there has been little ongoing collaboration in the shipping industry, and none in shipping at the scale of the collaboration between Maersk and IBM. Therefore, the focus can be seen as relevant.

This dissertation was supposed to be a case study of the collaboration between Maersk and IBM as well as the pilot studies conducted by them. However, as the subject is very new, little information can be found on the subject. Also, during data collection Maersk and IBM were waiting for permission to fall into place for what was supposed to be a joint venture, and therefore some of the interview respondents were reluctant to discuss their collaboration in too much depth. Although adequate data was collected to conduct a sufficient empirical analysis and to answer the research question, perhaps if the interviews had been conducted after permissions were in place and representatives from Maersk and IBM had received the green light to proceed with TradeLens, interview respondents would have been willing to open up to a larger degree and provide more information.

7 EMPIRICAL ANALYSIS:

The Triple-A framework presented by Lee (2004) is geared to manufacturing. The literature review by Gunasekaran et al. (2017) discusses the need for synergy between the Triple-A's in order to gain a sustainable competitive advantage when implementing conventional IT, and the article by Tseng and Liao (2015) emphasizes that the more integrated the supply chain the greater the performance, which is greatly aided by the application of IT. Although none of these articles discuss blockchain technology, the main points drawn from each article also apply when considering blockchain. Data has also been drawn from online newspaper articles specifically discussing the Maersk-IBM collaboration, as a way of triangulating the data collected through the interviews, and in order to fill in the holes in the data. What is of importance is to determine in what ways blockchain technology can help maritime supply chains create synergy between the Triple-A's. As the Triple-A theory and therefore the interview guide are in three sections: Agility, Adaptation and Alignment, the empirical analysis is presented and discussed accordingly.

7.1 AGILITY

As mentioned in the literature review section 5.1.1 of this dissertation, Agility has to do with sudden changes in supply and demand (Lee, 2004; Gunasekaran et al., 2017). According to the Triple-A theory, in order for a supply chain to be Agile it must respond quickly to short term changes in supply and demand by handling unexpected external disruptions both smoothly and cost efficiently. As such, it is more short-term. What is especially vital during, for example, environmental uncertainty is the access to up-to-date information and therefore that there are no information delays. Also, having a dependable logistics system in place is necessary. This, in turn, leads to improved cost performance. Producing and storing market information about past transport records, arranging and predicting future container flows, and the automatic exchange of information allowing

supply chain partners to be better informed and in turn allowing them to make earlier decisions, are some of the ways that can help the container shipping industry to develop market focused responses and support market oriented behavior and efficient and timely container processing.

When looking into the data from the interview respondents and from the online newspaper articles, there seem to be different views on blockchain technology.

There seemed to be a general consensus amongst the interview respondents, as well as within the online newspaper articles, that one of the ways that blockchain technology can improve Agility is through the access to information in real time, and as such, that the information is up-to-date and that there are therefore no information delays, which in turn allows supply chain partners to respond more quickly to disruptions. As stated by Vedel, "you see, in the industry, a lot of silos systemwide. You get the full visibility within each silo, but… the thing is, if you look at the interim supply chain, you have gaps, or holes… and holes often come as a time delay, or missing information". Hvid Jensen states that "what is happening with the… whole… digitalization of everything, is that obvious information about what is happening is shared a lot faster". Axelsen and Laursen also discussed the importance of the speed of information saying that… "there is something with speed here… that the blockchain can… support… And all else equal… if we are talking about… sudden changes in supply and demand, and so on. By being able to communicate faster, and at the same time let it be as safe, well then… it should also be more agile against… sudden changes". Belshaw echoes this sentiment when discussing Blockchain, although when combined with the other services provided by TradeLens. She said "it's about the full solution and how it utilizes technologies like blockchains and the information that it provides in real time that allows users of the platform to react with greater speeds than they would be able to otherwise". In his blog post in LedgerInsights, Morris states that "participants will be able to go to one place to track real-time status of

a container and to locate and transact with up-to-date trustworthy trade information. Blockchain is a critical ingredient. It creates immutable records of transactions which enables the ecosystem to track the exchange of critical information, like records of inspections, bills of lading, Customs documents. This access to information in real time will greatly streamline work flows". To quote Vedel… "If you suddenly get real time data and you're used to getting data once a day, or every twelve hours… is that going to change how you work? I think it is". A large part of being able to access information in real time in order to respond quickly to changes in supply and demand smoothly and cost-efficiently is the removal of friction within the supply chain. Dueholm mentioned that "there's a lot of… friction in the overall value chain that disappears when you go into Blockchain". One of the benefits of adopting blockchain technology is "the fact that you share some data… in a common fashion allows you to… just share the status of something and keep the internal mess internally" and "you have… this democratic database that will give you the ability to optimize processes and… also the fact that you have the transparency into where things are sitting".

Another way with which there seemed to be a general consensus among interview respondents and in the online newspaper articles that blockchain technology could improve Agility was the dependable logistics system that it provides. Morris, above, mentions trustworthiness and immutability. Belshaw highlights the security and trust gained saying that "it's not the only technology that would enable that instant sharing of documents. It's the fact that it facilitates that but at the same time provides the security around those documents, and the fact that they are the accurate, latest version". In his article on AppDeveloperMagazine, Bains states that "another edge the blockchain approach has over traditional cloud storage is that of dependability: disasters in geographical locations that encompass central databases can range from minor nuisances caused by power outages, to severe ramifications halting business operations as an earthquake destroys one such center. This problem is nonexistent in distributed networks,

as redundant copies of data are dispersed across a number of nodes. In the case where one node goes offline (whether temporarily or permanently), an identical replica of the data can simply be retrieved from another - as such, a user has access to their data around the clock, with no downtime". The aspects of real-time, security and visibility are also echoed in Miller's article on TechCrunch in which he says, "Marie Wieck, GM for IBM Blockchain says the product provides a way to digitize every step of the global trade workflow, transforming it into a real-time communication and visual data sharing tool. The blockchain provides a couple of obvious advantages over previous methods. For starters, she says "it's safer because data is distributed, making it much more secure with digital encryption built in. The greatest advantage though is the visibility it provides. Every participant can check any aspect of the flow in real time, or an auditor or other authority can easily track the entire process from start to finish by clicking on a block in the blockchain instead of requesting data from each entity manually". Going more into depth, the benefits of the TradeLens Maersk/IBM collaboration, according to a spokesperson from Maersk, are summed up in the article on LogisticsManagement by Berman. "As development work progresses, the scope of the platform will be expanded to include a wide range of digital services and solutions, supporting efficient and safe trade for all players, including: Manufacturers, retailers, and other traders would benefit from a streamlined and improved supply chain allowing for greater predictability, early notification of issues, and improved inventory management; Shipping lines would benefit from increased visibility to improve the cost and reliability of operations, as well as pre-built connections to customers and partners; Logistics providers such as freight forwarders would be able to offer their customers improved, lower cost services given real-time access to the end–to-end supply chain information and digital tools for customs brokerage services; Customs authorities would get a better view of the flow of goods coming their way, enabling better allocation of resources and improved targeting accuracy for inspections; Ports and terminals would benefit from more efficient operations driven by

increased transparency, improved document flows and higher cargo throughput rates; and Banks providing digital trade finance products would get increased visibility into key events impacting their financing as well as the digital documentation supporting the transactions".

Blockchain could be seen as benefitting Agility but only when combined with the other services of the TradeLens services. Belshaw said that "our solution as a whole focuses on a number of different technologies that combine together to give the platform and its benefits. So, from my point of view, I would say that blockchain doesn't impact it directly"… "I wouldn't say that blockchain itself specifically enables that Agility. It's everything as a whole about the platform and the information it provides that enables someone to act in a much more agile manner". Along these lines, Hussain emphasized the fact that Blockchain could help with Agility but highlighted the importance of companies to have the appropriate technology in place in order to implement it. He said "if you build any kind of analytics system on top of blockchain technology… that might… be helping you identifying the… sudden changes in trends, et cetera. But again… that's on yourself".

There were also those that did not see blockchain technology as having a direct effect on Agility. Three interview respondents stated that Blockchain would not affect Agility. Hvid Jensen said that "blockchain's main purpose is not necessarily giving easy access to information". Hussain added to what he said earlier by saying "if there's certain changes in, let's say, a market… it also comes down to… what kind of company you are… How quick you are at identifying changes… The blockchain technology… won't be doing that for you. You might have some data that is much more reliable and… you might have enhanced your dashboards… with more data… but that's it". Vedel said "on the short

term, we, I wouldn't expect many things that would take advantage of the blockchain technology".

To sum up the above, although the opinions of the interview respondents, as well as from the online newspaper articles, were mixed, they were mostly positive. Overall, there seemed to be a general consensus that blockchain technology can improve Agility by allowing supply chain partners to swiftly react to sudden changes in supply and demand smoothly and cost efficiently. There are two main ways in which blockchain technology can be seen to improve Agility throughout the supply chain. The first major way that blockchain technology can improve Agility is by providing a more dependable logiostics system. The words that were used a lot by interview repsondents and in the online newspaper articles were trustworthiness, security, immutability, predictability, visibility, efficiency and a more streamlined supply chain, all of which are characteristics of a more dependable logistics system and one of the key ways a supply chain can become more Agile. The second major way that blockchain technology can improve Agility, and which is in part a result of a more dependable logistics system, is that there are no information delays, and that supply chain partners therefore have access to information in real time. Being able to access information in real time means that reaction time to sudden changes in supply and demand is a lot less, and the fact that the information is also more reliable.

There were a few of the interview respondents who had reservations about the degree to which blockchain technology can improve Agility. There were those who felt that blockchain technology could make the supply chain more Agile although not as a standalone technology but rather only when combined with other services, such as those provided by the TradeLens platform. Then there were also those who only saw blockchain improving Agility if each of the supply chain partners have the right technology in place for the technology to function optimally.

Last, there were a few respondents who did not see blockchain technology as improving Agility more than conventional IT has done.

7.2 Adaptation

According to the Triple-A theory described in section 5.1.2 of this dissertation (Lee, 2004; Gunasekaran et al., 2017), Adaptation has to do with being able to adjust the supply chain design to accommodate market and economic changes and, as such, it is more long-term than with Agility. This can be done through increased coordination amongst supply chain partners, leading to better communication, a greater ability to store and quickly access information, a more streamlined supply chain, and more efficient responses to changes in markets. This, in turn, would result in, amongst other things, the improved gathering of market intelligence, better recognition of structural shifts, and the identification of future trends, such as through economic tracking, and the overall streamlining of the supply chain. Adjusting the supply chain to accommodate market changes can be done through, for example, the arrangement and prediction of future container flows which allow supply chain partners to adapt accordingly, as well as the gathering and storage of information about suppliers and customers, and market supply and demand. Communication between supply chain partners can also improve through the automatic exchange of, as well as quicker access to, information, making the supply chain partners better informed and better able to make early decisions and develop market focused responses.

Although there were mixed opinions between the interview respondents and in the online newspaper articles on the ways that the implementation of blockchain technology can improve Adaptation, and whether it can improve it at all, there seemed to be a general agreement between the interview respondents and in the online newspaper articles that the implementation of blockchain technology can improve Adaptation. This is through the dependable logistics system that blockchain technology provides, as well as the increased

ability to access information in real time. As such it is very similar to Agility mentioned above.

Most important for Adaptation seems to be the dependable logistics system that blockchain technology can provide. More specifically, security and privacy are enhanced by maintaining unalterable records, and through the validation by participants and the authentication of transactions. In other words, that all partners in the supply chain have access to reliable information. In support, Belshaw stated that "blockchain… as a technology, helps drive the future of the industry and what the future standards would be, because if you consider, for example, the desire to remove the need for a physical bill of lading throughout the supply chain, people have wanted to remove that for a number of years, but what is different now, what is interesting, is that blockchain, because of the security and privacy element, seems as though it is a technology that can enable this transition, this industry shift… It helps you adapt to changing standards, or changing the way of workings, but at the same time it is also driving that change". She went on to say that "increasing the visibility and blockchain being able to ensure this single source of trust, this single source of the truth rather… helps to create the trust that is necessary to really take advantage of… the benefits and efficiencies that you can get from creating more streamlined and automated processes". Vedel also discusses the dependability and says that, currently, "some of the big issues in the supply chain… revolves around… transparency, visibility, trust. You have a lot of silo systems. You have a lot of information, data, a lot of documents that are all within proprietary systems. So, what blockchain offers is that you create networks that enables more participants, more organizations, companies, and people, to exchange information in a secure way". Another aspect of a more dependable logistics system is the removal of friction and, as such, the better stream-lining of the supply chain. When discussing this, Jensen claimed that "it is more a question of whether one... exploits the technology. That one gets it… streamlined. One gets it uniform, so that everyone is pulling on… the same handle in relation to blockchain… So, I

am sure that… it will also be very adaptable… towards possible changes that might occur in the maritime sector… in the long-term". Specifically considering Maersk, when considering whether Blockchain can improve reactions to fluctuations in trade, Jensen says that "Maersk is often hit very hard on that. When there is a lower trade they hit the rate and that's a tough one. So… that impacts that and I think that... But... Blockchain will not help with that because it's the macropolitical stuff and when its rate goes down they have to adjust".

There seemed to also be a general consensus between the interview respondents and in the online newspaper articles that instantaneous access to real-time information plays a key role in improving Adaptation with blockchain technology. According to Axelsen and Laursen, "there are infinite possibilities with… the use of… blockchain… Both as sum log for all transactions, but also that you…promote instantaneousness in those transactions… that are made, and so on", and also that "if you have, to a large degree, implemented blockchain technology support around in the industry, in several corners, then there is in principle no barriers to what blockchain can support… technically". According to Miller in his blog post in LedgerInsights, the benefits of blockchain for adaptation are that "throughout the trade each participant has real-time visibility access to supply chain according to permission levels, thus by validating the participants, authenticating transactions, distributing information, and maintaining unalterable records that are located or accessible through the platform".

There were some reservations amongst certain interview respondents, as well as within some online articles, about the ways that blockchain can improve Adaptation. In order for a supply chain to become more Adaptable, it is necessary for each supply chain partner to have the right technology in place to support blockchain technology. As stated by Hussain, "it's… very much dependent on which kind analytics or what kinds of application you will

be building on top of the more rich data set you might… have consumed… by having the blockchain technology… But, the blockchain technology itself... I don't know how that will be enhancing the adaption of… trends and changes in market". Following on from this he says that "it's a matter of changing your systems. And then, basically enabling some kind of blockchain underlying infrastructure. That's… how I would solve that kind of thing". Vedel also emphasizes the importance of having the right technology in place: "As soon as you do integration, you also have a new situation where you need to consider whether your new technology landscape is working in the best way". Also, as stated by Axelsen and Laursen, "the question is still whether… it makes sense in all situations". Although he did not see any support for adaptation currently Vedel stated that, "in the long term some of these changes will be more, you know, foundational, or fundamental" and resulting in "changes that could come from more transparency, more visibility, more trust or, at least, technology that ensures that trust is… created among… organizations or people, that don't trust each other today".

In summary of the above, the main elements of blockchain technology that are seen as improving Adaptation are a more dependable logistics system and access to real-time information. A more dependable logistics system and hence a more streamlined supply chain greatly improves coordination between supply chain partners, resulting in better communication, and, in turn, a greatly improved storage of, and access to, information. This, together with the fact that the information is more secure and trustworthy, means that the gathering of market intelligence is more efficient and also more reliable, and, in turn, supply chain partners can respond to market and economic changes a lot quicker and a lot more efficiently. There were a few, however, who had reservations about whether blockchain can benefit Adaptation. Also here, as with Agility, there was an emphasis on the need to have the right technology in place in order to use blockchain technology, as

well as the opinion that blockchain is not necessarily appropriate and beneficial in all situations.

7.3 ALIGNMENT

To briefly summarize the Triple-A theory as discussed in sections 5.1.3 of this dissertation (Lee, 2004; Gunasekaran et al. 2017), in order for a supply chain to be more Aligned, the interests of all the supply chain partners need to be more aligned, and the best way to do this is to incentivize the supply chain partners. Incentives should be established so that the supply chain partners improve the performance of the entire supply chain when improving their own performance. Of importance here is coordination between the partners in the supply chain, as well as the alignment of information, so that supply chain partners can gather and store the market intelligence needed in creating, maintaining and strengthening a systematic approach to cooperation. In shipping there are often great costs which can be due to, for example documentation errors and information delays, as well as inefficient management of containers that sit idle and unused. These costs are greatly improved by a more reliable supply chain and with the secure submission, validation and approval of documents leading, in turn, to reduction in time and costs on such areas as clearance and cargo movement. The collection of information on past records allows supply chain partners to arrange and predict container flows, as well as allowing for reduced turnaround time for ships which also result in lower freight rate costs, in turn benefiting the entire supply chain. In short, reduced operation costs, quick access to information, better communication throughout the supply chain, and better service quality are the main points of Alignment, as well s incentives for supply chain partners.

As mentioned in the previous paragraph, the most important element of Alignment is the incentivization of all partners in the supply chain. Although the opinions of the interview respondents, as well as in the online newspaper articles, were mixed, there seemed to be

mostly support for the improvement of Alignment through the implementation of blockchain technology. This is for various reasons.

Most interview respondents and online newspaper articles seemed to be in agreement that a major incentive to implement blockchain technology are the trust, transparency and visibility that it provides. Briefly put, blockchain technology is a single source of truth, an immutable record that gives complete clarity. Because there is less fear that other parties will use the information for their own advantage or that that information can be tampered with, this trust, transparency and visibility throughout the supply chain result in a greater incentive to share information. During his interview, Hussain discusses trust as an incentive by saying: "I think… the issue… with the old, or conventional, IT applications… hasn't really been the IT part of the systems. It's more been the trust between different shareholders or stakeholders within the supply chain"… "Where blockchain basically brings a value here is that… you are decentralizing not only data, but also the application of systems and… you're more safe… The [incentive] to share information is bigger because you are not afraid of… the different parties using the information in their own advantage, or that… the information is going to be redacted or changed by any parties". He goes on to say: "I think the… two main reasons for blockchain… disrupting the old way of… using the IT technologies is that you can now safely share information without being afraid of… the other parties doing any kind of weird stuff with the information, and also that the information is not silo anymore. It's more like distributed across… the relevant actors on the supply chain". Belshaw shared the same view of trust. "The idea that the platform, and the idea that the technology can provide you with a… single source of truth that you can have. An immutable record of transactions or changes when it comes to documentation, and you can have complete clarity that every party along the chain is seeing the same truth. The same version… That definitely helps to bring Alignment". Discussing also the benefits of efficiency and a more streamlined supply chain, as mentioned above, Belshaw said that "there is certainly… benefits associated with blockchain technology, and they really do

center around ways to create trust between most parties that then enable you to implement various different … process or system changes that improve speed and take out unnecessary steps"… "Increasing the visibility and blockchain being able to ensure this single source of truth… helps to create the trust that is necessary to really take advantage of… the benefits and efficiencies that you can get from creating more streamlined and automated processes". Trust is also echoed by Vedel during his interview. He stated that "blockchain doesn't come with all the controlling or auditing mechanisms, but it enables you to have the transparency and visibility into who made the different transactions along the way"… "It boils down to the fact that you… take out… any discrepancies and ambiguity, by ensuring that we have the same version of the truth". Jensen more specifically mentions visibility saying that "half of the time the containers are waiting. If you want to squeeze that waste out and have less buffers you need a more reliable supply chain. A more [transparent] supply chain… that will enable you to… squeeze that out. Because you trust it more and… so on that blockchain is very positive in having a transparent ledger, where it's visible to all the parties in the… supply chain". Similarly, Tredway states in his article that "for customs authorities it is intended to give real time visibility, significantly improving the information available for risk analysis and targeting, "which may eventually lead to increased safety and security as well as greater efficiency in border inspection clearance procedures". The importance of trust is summed up by Vedel, who said that "this is a protocol for people who don't trust each other". With blockchain technology, information is no longer contained in silos but distributed among the relevant actors in the supply chain. The IBM press release mentions that "the attributes of blockchain technology are ideally suited to large networks of disparate partners. A distributed ledger technology, blockchain establishes a shared, immutable record of all the transactions that take place within a network and then enables permissioned parties' access to trusted data in real time. By applying the technology to digitize global trade processes, a new form of command and consent can be introduced into the flow of

information, empowering multiple trading partners to collaborate and establishing a single shared view of a transaction without compromising details, privacy or confidentiality".

What most interview respondents and online newspaper articles also agreed on when discussing incentivization of supply chain partners to implement blockchain technology was the resulting efficiency and streamlining of the supply chain. Demand for efficiency gains and opportunities from the streamlining and standardization ofinformation across the industry have increased due to error-prone and inefficient processes. With blockchain technology, discrepancies and ambiguity are removed through transparency, and the visibility and more efficient communication result in reduced operational queries. According to an IBM press release, Michael J. White, former president of Maersk Line in North America, and CEO of the new company commented that "today, a vast amount of resources are wasted due to inefficient and error-prone manual processes. The pilots confirmed our expectations that, across the industry, there is considerable demand for efficiency gains and opportunities coming from streamlining and standardizing information flows using digital solutions". In short, some of the main benefits of implementing blockchain technology are the improved efficiency within, and streamlining of, the supply chain, as well as increased trust and transparency, improved visibility, and greater communication, throughout the supply chain.

The improved efficiency and streamlining of the supply chain results in another major way in which blockchain technology can incentivize supply chain partners and that is by cutting costs. According to Jensen, "it's more costly to… treat the papers around a container than it is to ship the container" and also that "if you take a look, a lot of areas where there is a lack of transparency, the lack costs a lot of money". The focus on costs is also echoed by Shields and Tredway. As mentioned in his article from BusinessInsider, Shields says that "industry executives expect blockchain will provide at least a 20% reduction in costs across global supply chains, largely through reducing paperwork that's used to document the

location of goods as they move from point to point". In his article from AutomotiveLogistics, Tredway says that, "for shippers, it can help reduce trade documentation and processing costs and help eliminate delays associated with errors in the physical movement of paperwork. It will also provide visibility of the container as it advances through the supply chain". When discussing TradeLens, Wee writes in his article from SeatradeMaritimeNews that, "during the 12-month trial, Maersk and IBM worked with dozens of ecosystem partners to identify opportunities to prevent delays caused by documentation errors, information delays, and other impediments. One example demonstrated how TradeLens can reduce the transit time of a shipment of packaging materials to a production line in the United States by 40%, avoiding thousands of dollars in cost. Through better visibility and more efficient means of communicating, some supply chain participants estimate they could reduce the steps taken to answer basic operational questions such as "where is my container" from 10 steps and five people to, with TradeLens, one step and one person". So costs can play a key role in incentivizing supply chain partners. As Dueholm said: "So, I think people will jump on… the blockchain because it can… save a lot of money and… do you need to… incentivise them?"

Collaboration is highlighted as an incentive in the blog post by Ross from ContainerManagement. He states that "TradeLens' trade document module, ClearWay, allows the various stakeholders in the supply chain to collaborate in cross-organizational business processes and information exchanges and is backed by a 'secure, non-repudiable audit trail". Baker, in his article from LloydsLoadingList, states that, "where the true benefits come from the platform is when you do have a wide geographic scope on the bottom, and where you can have as many players as possible on a single corridor onboard". According to a press release from IBM, "with the shared, immutable record of transactions taking place within a network and the permissioned access to trusted data in real time allows for a new form of command and consent that can be introduced into the

flow of information, empowering multiple partners to collaborate and establishing a single, shared view of a transaction".

The incentives for supply chain partners to implement blockchain technology to improve Alignment are summed up in an IBM press release in which they posit that "a shipping information pipeline will provide end-to-end supply chain visibility to enable all actors involved in managing a supply chain to securely and seamlessly exchange information about shipment events in real time"… "Paperless Trade will digitize and automate paperwork filings by enabling end-users to securely submit, validate and approve documents across organizational boundaries, ultimately helping to reduce the time and cost for clearance and cargo movement. Blockchain-based smart contracts ensure all required approvals are in place, helping speed up approvals and reducing mistakes". All in all, as stated by Maersk and reported by Baker, "through better visibility and more efficient means of communicating, some supply chain participants estimate they could reduce the steps taken to answer basic operational questions such as 'where is my container' from 10 steps and five people to, with TradeLens, one step and one person".

There are also some opinions amongst some interview respondents as well as in the online newspaper articles that reflect a disincentive to using blockchain technology.

One aspect of this view is the need for, yet difficulty in getting, a large majority of supply chain partners onboard. Hussain said that "it's safe to say blockchain technology won't work if you only have certain parts of… the supply chain onboard. He goes on to say that 'blockchain technology, or… these kind of system… They… don't have… any value if you're running it internally… The way… these kind of systems… or technologies, adds value are if you are operating across borders. Across businesses. So, you need to have, at least, a credible mass onboard… You might not need all the shippers in the world on this platform, but, at least, you need all the critical actors who's going to operate in some kind

of way in the supply chain onboard. Otherwise the… value of… the blockchain technology decreases a lot". This view was also shared by Axelsen and Laursen who said that… "as a starting point… if… there is a need… to do this, and people can see that there is an advantage to… automize things, or… make them visible in the whole logistics chain, transport chain, or whatever it may be… then I am convinced that… it can work but… it requires one to convince all interested parties of it, and… be smart about their project, because I don't know much about it… then I think that… it won't work… if not everyone is onboard". According to them, therefore, "the first step must be to convince and… get everyone onboard". As Vedel said, "for Maersk it doesn't make sense, and I think for global trade it doesn't make sense, if you have… just a regional version… It has to be full scale"… Of the importance of integration he goes on to say: "I think some of the learning we've had for now is that, as with many other IT projects that I've seen, is that integration takes a long time".

Another aspect that can deter supply chain partners from joining is the lack of trust. As Belshaw said, "you can design it, but if the actors don't believe it enough, or trust in it, then they'll just go straight back to the manual checks". Vedel considers how blockchain technology could affect supply chain partners saying that "you have the derived effects, so blockchain is hyped technology. Something that creates a lot of attention and a lot of publicity… So in that sense it might… change some of the business relationships that you see around… So people are thinking, this is something that may create new collaboration between companies, or between different organizations, institutions". Along those lines Dueholm states: "I think resistance because you are breaking some business model down, and there you will have a fight back".

What was seen as another disincentive by interview respondents and in online newspaper articles is the need for standardization. Axelsen and Laursen state that they are "certain that the potential is there if… everyone offers in".. "We need standardization here… so

that we are making use… of the same"… "If there is a need, or if… the requirement is Alignment then we also demand that one is on the same system, as I said. Or at least make it possible that the systems… at a minimum, can talk together and understand each other"… and therefore that "the first step must be to convince and… get everyone to get onboard". This need for standardization is echoed by Jensen who said that the lack of standardization is "definitely the biggest problem because… you have to agree on the standard, on the Smart Contracts, and the consensus algorithms" and "also reading data from the blocks… also has to be standardized". A large element of this standardization issue, according to Murphy, is interoperability. "One of the big things missing from most blockchain conversations is interoperability".

Complexity as a disincentive is mentioned by Vedel. He says that "Maersk consists of a number of companies… A number of brands. Even within these brands there are different versions of the truth. So, we have a lot of systems that hold some of these documents in different places. So, even just harmonizing that internally would bring value. So, then you add the complexity of external parties… you add the complexities of a global operation".

A last disincentive, according to Jensen, is a loss of power. "A lot of companies, also the freight forwarders, they are delivering from the asymmetric in information. They have information that others do not have. In their islands they have some information and they can profit from that. Being the only ones that have that information. Or they think it's the only one that have that information, and thereby… if that gets opened up and transparent, they lose the reason for getting to take a big profit out of that". Along a similar line, Dueholm states that "a lot of people will see this as a threat to them because that's where they make their living". A flip-side to this loss of power is the potential dependency by committing to one particular blockchain. Jensen said that, "when you go into blockchain, are dependent on blockchain, you cannot swap to another blockchain technology. You have no alternatives. You are dependent on this technology and the provider behind it".

So, as can be summed up fro the data, there seemed to be a general consensus among the interview respondents, as well as within the online newspaper articles, that implementing blockchain technology could improve Alignment throughout the supply chain. This is because blockchain technology can greatly improve trust and transparency, and in turn visibility. Blockchain technology can also make supply chains more efficient and streamlined, improving coordination while also greatly cutting costs. All these can be seen as incentives for supply chain partners to implement blockchain technology and thereby strengthen the overall supply chain. These incentives allow supply chain partners to coordinate and align information in a more efficient manner, in turn allowing them to gather and store market intelligence and to create, maintain and strengthen a more systematic approach to cooperation. All of the above, as well as the digitization of documentation, are seen to cut costs drastically, as mentioned. However, there is a need to get most if not all of the supply chain partners onboard for the system to work, and it is therefore vital that partners are convinced of the benefits of implementing blockchain technology. Also, even though trust and transparency are increased, there is still some distrust surrounding blockchain technology. This is in part because blockchain technology is a very new and hyped technology, and in part because of the complexity of the global supply chains of shipping which result in greater complexity of operations. There can also be resistance from supply chain partners. This can be from a refusal to move away from manual processes, or because old business models will become obsolete while creating new ones. For some information can be seen as power over competitors and, because of the nature of blockchain technology, much of this power will have to be relinquished if supply chain partners implement blockchain technology, something that can create resistance. Last, the lack of standardization and interoperability can be a great disincentive for supply chain partners.

8 CONCLUSION

8.1 INTRODUCTION TO THE CONCLUSION

The supply chains of the shipping industry are not only global in nature, but also highly intricate, and as such they differ from typical supply chains, such as in manufacturing. The shipping industry is increasingly turning to blockchain technology as a way of streamlining and improving supply chains, as well as improving trust and transparency. Proof of this are the many pilot studies being conducted within the shipping industry, and especially the ongoing collaboration between Maersk and IBM, the case focused on in this study, and which culminated, at the beginning of 2018, in a blockchain platform called TradeLens. Blockchain technology is seen as a viable solution to many of the issues within shipping supply chains, but in which ways does it benefit supply chain partners? The aim of this research has been to determine the ways in which blockchain technology can improve the Agility, Adaptation and Alignment of Lee's (2004) Triple-A framework, creating a synergy between the three and thereby a sustainable competitive advantage for the supply chain partners in the shipping industry. In order to answer the research question and satisfy the research aim, data was collected from interviews with relevant individuals from Maersk, IBM, DMA as well as a professor from CBS. Secondary data was also collected from online newspaper articles. All the data was uploaded to NVivo and coded, and analyzed. The next paragraph will summarize the findings. This will be followed by a section about the contribution of the research and a section about the limitations to the research (other than the limitations stated in section 6.5 of the methodology)nas well as contributions to the literature and suggestions for future research. The last section is a reflection of the research.

8.2 Summary of the Findings and an Answer to the Research Question

A stated in section 2.4 of the Introduction the research question is:

"Can blockchain technology improve the supply chains in the shipping industry and help supply chain partners gain a sustainable competitive advantage?"

This research question will be answered in the following section.

In order to answer the research question, and as mentioned in the Methodology chapter, this dissertation has drawn on the Triple-A framework by Lee (2004), and the empirical data has been analyzed accordingly. The findings of the data analysis show that the interview respondents, as well as the online newspaper articles, seem to agree that blockchain technology satisfies the three attributes of the Triple-A model: Agility, Adaptation and Alignment. Two features of blockchain technology in particular seem to be particularly important for all three of the Triple-A's. The first major feature is a more dependable logistics system which results in increased trustworthiness, immutability, security and dependability. The second major feature is the access to information in real-time and therefore no information delays. We are now going to look one by one at each of the Triple A's, the conceptual framework of this dissertation. For Agility, the two abovementioned features of blockchain technology means that the information that is accessed can be counted on when quickly, smoothly and cost-efficiently having to develop responses to sudden changes in supply and demand. For Adapatation, these attributes allow supply chain partners to collect reliable economic and market information with which to develop proper economic and market responses. Also, access to information in real-time makes supply chain partners better informed and better able to make early decisions and develop market responses earlier. For Alignment, these benefits can incentivize the supply chain partners to increase cooperation and collaboration, since each partner in the supply chain has access to the same data, and that the data can be trusted. Also, it allows partners to gather and store market intelligence so that a systematic approach to

cooperation throughout the supply chain can be better created, maintained and strengthened, while also lowering costs. A third major feature which is very relevant for Alignment is cost improvement, which is seen by interbiew respondents, and in the secondary data, as being a major incentive for supply chain partners to implement blockchain technology.

As mentioned, the benefits from implementing blockchain technology overlap in many ways between Agility, Adaptation and Alignment, and as such one could say that a synergy is created when implementing blockchain technology, thereby helping supply chain partners gain a sustainable competitive. However, there were also some reservations amongst certain respondents about whether blockchain technology can satisfy the Triple-A framework.

Although most opinions of the implementation of blockchain technology were positive for each of the Triple-As, there were however, some who only saw blockchain technology as only satisfying the Triple-A when used in conjunction with other services, such as those provided by TradeLens, and therefore did not see blockchain technology as a means of creating a synergy as a stand-alone technology.

Also, there were certain areas that were considered by some as being barriers to the implementation of blockchain technology. In order for supply chain partners to create a synergy between Agility, Adaptation, and Alignment by implementing blockchain technology, and thereby create a sustainable competitive advantage, there are certain aspects that need to be in place. First, it is vital that each supply chain partner has the right technology in place to really take advantage of blockchain technology. Second, if not all then at least a large majority of supply chain partners need to be onboard for the implementation to make sense. Third, it is not enough for each individual partner to have the right technology in place. They also have to trust blockchain technology and believe that it is a technology that they need, and that it will work despite the complexity of the

global nature of international shipping. Fourth, standardization of the technology as well as interoperability between the different systems are vital. Many supply chain partners may be hesitant to come onboard if these two aspects are not in place. Fifth, it is important to convince all supply chain partners that, despite the new business models it will create and the old business models that will crumble, that the technology is viable. Last, those that see information as power need to be convinced that the advantages far outweigh the disadvantages of losing information as a result of a distributed data base, and they must therefore be convinced that Blockchain can benefit more than the power lost would.

8.3 Contribution

The contribution of this study to existing knowledge can be seen as two-fold.

First, little research has been conducted using the Triple-A theory as a framework for analysis in the shipping industry. Also, no research has yet been conducted, as far as I am aware, using the Triple-A framework for analysis of blockchain technology, and therefore no literature or research exists using the Triple-A framework to analyze both blockchain technology and shipping in a single research project. More specifically, the Triple-A framework presented by Lee (2004) was originally geared towards manufacturing supply chains. In their literature review Gunasekaran et al. (2017) used the Triple-A framework to determine the ways that conventional IT implementation could affect performance in shipping (see section 5.2). As far as is known, this study is the first study conducted that uses the Triple-A framework to determine the ways in which blockchain technology can create a sustainable competitive advantage.

Second, as can be concluded from the research, the implementation of blockchain technology can create the synergy between the Triple-A's (Agility, Adaptation and Alignment) that, according to Lee (2004), is vital for supply chain partners to gain a

sustainable competitive advantage. However, in order to fully make use of, and fully benefit from, blockchain technology, it is of utmost importance that each supply chain partner has the right technology in place. This is a responsibility that rests on the individual supply chain partner, and as such it is of importance that the supply chain partners are convinced that they can not only trust blockchain technology, but also that the system is viable. Also, creating a successful blockchain platform relies on a large majority of supply chain partners being onboard for it to function optimally. Blockchain technology will not benefit the supply chain as a whole if it runs in parallel with conventional systems. Last, standardization is vital, as is interoperability between systems.

8.4 Theoretical Limitations

Lee (2004) makes many suggestions for the ways with which companies can improve Agility, Adaptation and Alignment. However, since his framework was initially developed for manufacturing, not all of these suggestions are can be transferred to the shipping industry. Adaptation in particular was difficult to transfer to the shipping industry and it seemed that many of the suggestions he makes for supply chains to become more Adaptable are not really relevant. However, there was enough for Adaptation to be included in the analysis.

8.5 Reflections

As mentioned in the Methodology section (6.5), there is currently little data available on blockchain technology, and even less on the use of blockchain technology within the shipping industry. This will invariably change as blockchain technology starts to move away from the beta stage, pilot studies are finished and practical uses are increasingly implemented. It will be interesting to conduct research at a later stage to see the ways in

which the results of the same study, or a similar study to this one, will vary. It will be especially interesting to conduct the research with an increased focus on TradeLens, once it has been fully implemented and the true benefits become apparent.

As was also mentoned in Methodology section 6.5, the interviews were conducted before all relevant permissions were in place and Maersk and IBM had the go-ahead to proceed with TradeLens. Perhaps the data collected through interviews would have been richer and more in depth had the interviews been conducted after permissions were granted. It would be interesting to conduct the same research now or at a later date and observe the differences.

There is little doubt that, had the research been conducted by two people or within a group, the research would have been conducted differently, the data would have been more rich, and the analysis, if not very different, then a little different. However, at the onset of the dissertation is was not deemed possible, or fair, to commit to writing this dissertation with others.

8.6 Self Reflections

The entire study has brought new experiences for me, and there were many aspects that I had never tried before, such as conducting interviews and working with NVivo. I feel that it would be interesting to see whether the results would be the same if the same study was conducted again, now that I have gained more experience as a researcher. I do not doubt that the results would be different but the data would also be richer and more in depth. Because of the lack of experience of the researcher in certain aspects, and because of the continuously changing and evolutionary character of Blockchain, conducting the research at ongoing intervals would not only provide different results but would be interesting for future research due to the wealth of knowledge it would provide.

9 APPENDICES

9.1 APPENDIX 1

INTRODUCTION

Because of growing globalization and the global nature of container shipping, the supply chains of the container shipping industry are becoming increasingly complex, crossing many borders and tying many different countries and industries together. Global news is increasingly discussing blockchain technology, the new and exciting ways in which it can be used, and the adoption of this technology in different industries. Whereas the maritime industry has previously relied on traditional information technology (IT) applications, some shipping companies are now turning to blockchain technology as a way of simplifying and streamlining the supply chain while increasing security and transparency. What, specifically, is of interest is the ways that blockchain technology can improve the supply chains in the container shipping industry, and therefore the benefits that it brings.

The contemporary global economy is witnessing increasing globalization, shorter life cycles of products and technologies, and global outsourcing. This in turn is increasingly stimulating movements of cargo, international procurement, and new distribution strategies in multinational companies, while redefining maritime logistics and proving that a distribution channel with reliable global transport coverage is essential.[1] International trade is also increasing. According to the IMO (2008) maritime transport carries 90% of global trade volume. Ocean liner shipping companies play a main role in facilitating international trade through their involvement in the commerce and marketing of global

[1] Seo et al., Pages 292-293

trade, and by enabling the physical transport of cargo.[2] More specifically, containerization enables the safe movement of goods and facilitates intermodal transport. Also, with increasing preference for door-to-door services, maritime logistics organizations have been prompted to accept responsibility for transporting container cargoes door-to-door and to assume increased supply chain management functions.[3] Optimizing the supply chain relies heavily on the performance of transport providers in the coordination of such things as equipment, terminal handling, freight rates, follow up and high level of information technology (IT).[4]

According to Tseng & Laio (2015), because of the pressures that supply chain partners exert on container shipping, and with the developments within IT, the adoption of IT applications has become an increasingly popular way of streamlining transport services, and storing information.[5] This can especially be seen with the adoption of blockchain technology currently occuring in the shipping industry. Through its distributed ledger technology, blockchain technology is now seen as a way of digitising the litany of paper documents, such as bills of lading, letters of credit, contracts of sale, and charter agreement contracts, which have defined maritime transactions until now.[6] Simply put, blockchain is a database, or ledger, that tracks transactions, hosted across many nodes and cryptographically guarded from fraud. Using blockchain to manage freight tracking makes sense due to the many parties and the high levels of risk involved.[7] Using blockchain technology would enable the exchange of supply chain transactions and documents in real

[2] Yang, Page 236

[3] Seo et al., Pages 292-293

[4] Papadopoulou et al., Page 77

[5] Tseng & Liao, Page 85

[6] http://www.marinemec.com/news/view,blockchain-technology-will-transform-the-maritime-industry_47115.htm

[7] http://fortune.com/2017/03/05/maersk-tests-blockchain-based-freight-tracking/)

time, minimize the time products spend in the shipping and transit process,[8] improve inventory management, and, ultimately, reduce waste and cost.[9] Also, because no one party can modify, delete or even append any record without the consensus from others on the network, the level of transparency helps to reduce fraud and errors.[10]

As mentioned above, the shipping industry is increasingly adopting blockchain technology. In Korea, a country with one of the largest industrial ports in the world, the IT subsidiary and technology provider for Samsung, Samsung SDS, has launched a pilot blockchain project with a consortium of members of the Korean maritime industry in order to track imports, exports, and cargo shipment locations.[11] Through a pilot project, the Danish Maritime Authority (DMA) is exploring the potential of blockchain in the entire ship registration process in Denmark in order to create a more efficient, open and secure approach to ship registration, as well as promoting the technology across the country's marine industry.[12] Brian Mikkelsen, Denmark's former Minister of Economic and Business Affairs, said: 'The Maritime Strategy Team has recommended full digitalisation of, inter alia, the Register of Shipping'… 'By means of an entirely new technology such as blockchain, this pilot project may pave the way for a more open, secure and efficient registration of ships on the Danish registers'…'This is important in an industry with a distinct focus on keeping costs low and where trust in all the parties involved is a necessity'.[13]

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[8] http://www.reuters.com/journalists/gertrude-chavez-dreyfuss

[9] https://www.siliconrepublic.com/enterprise/blockchain-ibm-maersk-shipping

[10] https://www.siliconrepublic.com/enterprise/blockchain-ibm-maersk-shipping

[11] https://www.cryptocoinsnews.com/samsung-sds-puts-blockchain-use-koreas-shipping-industry/

[12] http://www.ship-technology.com/news/newsdma-launches-pilot-project-to-examine-blockchain-technology-for-shipping-industry-58229299

[13] http://www.ship-technology.com/news/newsdma-launches-pilot-project-to-examine-blockchain-technology-for-shipping-industry-58229299

Maersk has also been collaborating with IBM in order to implement blockchain technology. With approximately 18% to 20% share of the market, Maersk is the largest container carrier in the world.[14] Undertaking a test container shipment from Mombasa to Rotterdam, Maersk and IBM calculated that the cost of moving the container was roughly $2,000, with paperwork making up around $300 – between 15 % and 20 % of the total cost.[15] Also, the shipment went through more than 30 people and organizations, with more than 200 different communications between them.[16] This technology, therefore, has the potential to make massive, scalable savings in these areas.[17] With plans for up to 10 million of the 70 million containers shipped annually by Maersk to be managed by blockchain[18], Maersk and IBM aim to get rid of all paperwork thereby making the process of shipping containers smoother and faster, and allowing all partners to keep track of goods and be able to check where the shipment is at any point.[19] 'Working closely with Maersk for years, we've long understood the challenges facing the supply chain and logistics industry and quickly recognized the opportunity for blockchain to provide massive savings when used broadly across the ocean shipping industry ecosystem,' said Bridget van Kralingen, senior vice president, industry platforms, at IBM.[20] The blockchain used by IBM and Maersk is a permissioned blockchain, an unchangeable, highly secure and trusted shared network, where all participants are known, have permission to participate, and have end-to-end visibility.[21] 'We are excited about this cooperation and its potential to bring substantial

[14] https://www.forbes.com/sites/tomgroenfeldt/2017/03/05/ibm-and-maersk-apply-blockchain-to-container-shipping/#164638f53f05

[15] http://www.supplychaindigital.com/technology/maersk-and-ibm-are-bringing-blockchain-tech-shipping-industry

[16] http://www.reuters.com/journalists/gertrude-chavez-dreyfuss

[17] http://www.supplychaindigital.com/technology/maersk-and-ibm-are-bringing-blockchain-tech-shipping-industry

[18] https://www.siliconrepublic.com/enterprise/blockchain-ibm-maersk-shipping

[19] https://www.engadget.com/2017/03/07/maersk-shipping-ibm-blockchain/)

[20] http://www.reuters.com/journalists/gertrude-chavez-dreyfuss

[21] https://www.forbes.com/sites/tomgroenfeldt/2017/03/05/ibm-and-maersk-apply-blockchain-to-container-shipping/#164638f53f05

efficiency and productivity gains to global supply chains, while decreasing fraud and increasing security,' said Ibrahim Gokcen, chief digital officer at Maersk. 'We expect the solutions we are working on will not only reduce the cost of goods for consumers, but also make global trade more accessible to a much larger number of players from both emerging and developed countries.'[22]

Previously there has been little focus on container shipping supply chain integration. According to Tseng and Liao (2015), even though the container shipping industry faces both supply uncertainty and an acceleration in customer service demand due to the often turbulent competitive global economy and the dynamic environment in which it operates, studies in this area are scarce. Also, as blockchain technology is very new, few academic articles have been written on the subject, especially on the use of blockchain technology in the container shipping industry. The research will draw on the concepts of agility, adaptation and alignment from Lee's Triple-A framework, all of which he posits are necessary in order for a company to go beyond a competitive advantage and gain a sustainable competitive advantage. More specifically:

'How can the use of blockchain technology help container shipping companies satisfy Lee's Triple-A framework in order to gain a sustainable competitive advantage?'

In answering this question, the benefits of using blockchain technology on conatiner shipping supply chains will be determined. In order to gain insight into the ways blockchain can help to better integrate the supply chain, interviews will be conducted with relevant

[22] https://www.siliconrepublic.com/enterprise/blockchain-ibm-maersk-shipping

players at both Maersk and IBM, with particular focus on the trans-Atlantic pilot study undertaken by the two at the beginning of 2017.

This research paper is structured as follows. Section 2 contains background information on container shipping and blockchain technology. Section 3 contains the literature review and discusses theory. This will continue to the operationalization of the chosen theory and the research design in section 4, and the results of the research in section 5. Section 6 will discuss the findings, the limitations of the research as well as suggestions for future research, and section 7 will conclude with an answer to the problem statement.

9.2 APPENDIX 2

INTRODUCTION:

- What is your name?
- In which company and department do you work?
- Do you work directly with IT and/or blockchain technology?
- How do you think blockchain technology can improve your supply chain?

AGILITY:

- How did/does conventional IT application help you to create contingency and back-up plans, assure no informations delays, and to quickly redesign your supply chains in response to unexpected situations and sudden changes in supply and demand (in other words, to become more agile)?
- How do you believe blockchain technology will improve this, and how do you intend to implement it so that the supply chain is more agile (i.e., be able to respond to sudden shocks and fluctuations in supply and demand)?

ADAPTATION:

- How did/does conventional IT application help you identify future trends, develop new suppliers, and track economic changes in order to adjust and evolve to market changes (in other words, to become more adaptive)?
- How do you believe blockchain technology will improve this, and how do you intend to implement it so that the supply chain is more adaptive (i.e., be able to respond to market changes)?

ALIGNMENT:

- How did/does conventional IT application allow equal access to data throughout the supply chain, the alignment of identities, and the redefinition of partnerships in order to incentivise supply chain partners to share not only risks and costs, but also rewards (in other words to become more aligned)?
- How do you believe blockchain technology will improve this, and how do you intend to implement it so that the supply chain is more aligned (i.e., to collaborate for the benefit of the entire supply chain)?

CONCLUSION:

- What is your opinion of blockchain and the supposed benefits of it use?

9.3 APPENDIX 3

INTRODUCTION:

- What is your name?
- In which company and department do you work?
- Do you work directly with IT and/or blockchain technology?

AGILITY:

- Compared to conventional IT, how does blockchain technology help supply chains to respond quickly to sudden changes in SUPPLY and DEMAND, handle UNEXPECTED EXTERNAL DISRUPTIONS smoothly and cost-efficiently, and recover promptly from SHOCKS (natural disasters, computer viruses…)?

ADAPTATION:

- Compared to conventional IT, in what way does blockchain tecnology help supply chains to EVOLVE OVER TIME as markets are reshaped (economic progress, political shifts, technological advances…), and ADJUST supply chain design to ACCOMMODATE MARKET CHANGES?

ALIGNMENT:

- Compared to conventional IT, in your opinion, how does blockchain technology help supply chains to ALIGN the INTERESTS of the entire supply chain, and establish INCENTIVES for partners to improve overall supply chain performance.

GENERAL:

- In your opinion, what are the advantages of using blockchain technology?
- In your opinion, what are the disadvantages of using blockchain technology?
- What is your overall opinion of blockchain technology?

9.4 APPENDIX 4

TRIPLE-A

AGILITY:

- Respond quickly to sudden changes in SUPPLY and DEMAND.
- Handle UNEXPECTED EXTERNAL DISRUPTIONS smoothly and cost-efficiently.
- Recover promptly from SHOCKS (natural disasters, computer viruses…).
- Supply chains can become more AGILE via:
    - The continuous supply of information about supply and demand to supply chain partners so that they can respond quickly.
    - Collaboration with supply chain partners on back-up plans.
    - Ensuring that there is no information delays.
    - Building a dependable logistics system.

ADAPTATION:

- EVOLVE OVER TIME as markets are reshaped (economic progress, political shifts, technological advances…).
- ADJUST supply chain design to ACCOMMODATE MARKET CHANGES.
- Supply chains can become more ADAPTABLE via:
    - Recognizing STRUCTURAL SHIFTS EARLY by capturing the latest data, filtering out noise and tracking key patterns.
    - Tracking ECONOMIC CHANGES leading to changes in supply chain operations.

- Deciphering the needs to all customers, not just the immediate ones.
- Developing new suppliers that complement existing ones so that they retain the option to ALTER THEIR SUPPLY CHANGE.

ALIGNMENT:

- ALIGN the INTERESTS of the entire supply chain.
- Maximize the performance of the entire supply chain while maximizing their own.
- Establish INCENTIVES for partners to improve overall supply chain performance.
- This can be done via:
    - The redefinition of relationship terms so that all risks, costs and rewards are shared fairly through the alignment of:
    - INFORMATION (access to forecasts, sales data, plans…).
    - IDENTITIES (redefine the roles and responsibilities of each partner in order to avoid conflict).
    - INCENTIVES (predicting the possible behavior of partners in light of their current incentives).

9.5 APPENDIX 5

INTERVIEW SPØRGSMÅL.

- Hvad hedder i?
- I hvilken afdeling sidder i?
- Arbejder I direkte med blockchain teknologi?
- Hvordan, og på hvilket område, bruger I blockchain teknologi?

FLEKSIBILITET (Agility):

- Efter jeres mening, og på kort sigt, hvilken effekt vil blockchain teknologi have på evnen til at reagere på pludselige ændringer i udbud og efterspørgsel inden for det danske maritime industri?

TILPASNING (Adaptation):

- Efter jeres mening, og på lang sigt, hvilken effekt vil blockchain teknologi have på evnen til at tilpasse sig markedsændringer inden for det danske maritime industri?

FORENING (Alignment):

- Efter jeres mening, på hvilken måde vil blockchain teknologi forbedre, og stimulere, tilpasningen mellem det danske maritime industris forskellige deltagere?

GENERALT:

- Hvad ser i som fordelene ved brugen af blockchain teknologi?
- Hvad ser i som ulemperne ved brugen af blockchain teknologi?
- Hvad er din/jeres overordnede mening om blockchain teknologi?

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Jan Lillelund (in person): 8 February 2018.