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Understanding the motives for digital transformation in the container shipping sector

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UNDERSTANDING THE MOTIVES FOR DIGITAL TRANSFORMATION IN THE CONTAINER SHIPPING SECTOR.

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DECLARATION

I certify that all the material in this dissertation that is not my own work has been identified, and that o material is included for which a degree has previously been conferred on me.

The contents of this dissertation reflect my own personal views, and are not necessarily endorsed by the University.

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ABSTRACT (NOTE: MAX 300 WORDS)

Title of Dissertation: **Understanding the motives for digital transformation in the container shipping sector.**

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This thesis aims to understand the motives behind digital transformation strategies for the container shipping sector. Due to limited resources, the thesis has been built around key concepts identified applicable to the topic of research. Followed by reviewing the current maritime transport sector through an industry analysis through the use of Porters 5 forces. The research then aims to understand the trends, developments along with the structure of a specified market to understand the motives behind digital transformation.

KEY WORDS: Digital transformation, Information management, Intelligent processes, innovation, Integration, industry 4.0, sharing economy

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LIST OF ABBREVIATIONS

The following abbreviations are used in this dissertation:

3D	**Three Dimensional**
AIS	**Automatic Identification system**
BIMCO	**Baltic and International Maritime Council**
CO2	**Carbon Dioxide**
DWT	**Dead Weight Tonnage**
HMM	**Hyundai Merchant Marine**
IMO	**International Maritime Organisation**
M&A	**Mergers and Acquisitions**
MSC	**Mediterranean Shipping Company**
RFID	**Radio-frequency identification**
UASC	**United Arab Shipping Company**
UNCTAD	**United Nations Conference on Trade and Development**
WMU	**World Maritime University**

INTRODUCTION

After the recent economic crisis in 2008, the maritime industry, specifically the container shipping industry has been hit hard, making it unprofitable and an extremely volatile market due to the decreasing amount of freight available versus the surplus of container vessels available in the maritime transport sector. Other factors such as the global economic crisis and according to Mckinsey "the efforts by corporate customers to control costs". The reality is that companies within the shipping industry need to take initiative to turn the current situation around as the industry, find ways to embrace the changes to better adjust because in many ways has hardly gone through change since 1956.

According to Ernst & Young (2011) publication on digitalisation and how organisations need to adapt to change consumer behaviour is summarised in the quote below.

> *"Digitalisation is a step change even greater than the internet. Exponential technology advances, greater consumer power and increased competition mean all industries face the threat of commoditisation. The winners will act now, and build a strategic advantage that leaves their counterparts wondering what happened."*

The business environment has always expected organisations to be dynamic and adapt or die. Today's business environment and its customers have moved towards an increased desire for fast services which in turn have led to faster changes in the business environment. The drive for faster services, improved processes and all round better efficiency whilst also desiring the cutting down of operational cost has also increased our reliance on technology.

Digitalisation in its simplest form is the conversion of analogue, physical data, into digital information and through the continuous extension and growth of digitalisation, the end result is to move towards creating more interconnected networks. Therefore, the focus of this research would be on the connectivity of the maritime transport industry. As technology further develop, the maritime industry cannot be left behind. Over the years' vessels will become more accessible through the connection of systems and components to the internet and through this changing the way the industry manages information. At the moment, the most digitalised section of maritime transport would be the navigation systems, for example the concept of e-navigation and the ongoing developments within navigation in general. The bigger picture is to grow digitalisation throughout the maritime transport to increase efficiency.

It is commonly known that the shipping industry has been a reactive rather than a proactive change type of industry due to the volatility of the industry. From the development of conventions to managing with economic challenges. But the way in which the general business environment has change, does not allow for this type of reactionary stand point anymore. Businesses in today's environment will do anything and everything to remain relevant, even if it means taking bigger risk such as branching out into different industries in order to stay relevant. Relevance has not only become the only factor, but consistent economic concept behind businesses, profit maximisation through the decreasing of operational costs. Through the concept of digitalisation, organisations such Google have entered into car manufacturing, Tesla into space exploration, Uber into self-driving-trucking and Amazon recently acquiring an ocean freight license in China. What all these organisations have in common is their exceptional ability to manage big data. Big data refers to the analysis of large digital data collections in order to uncover patterns, trends and changes especially in terms of human behaviours and interactions. Through this, these organisations and digital based industries have had a significant advantage over other organisations and industries in terms of understanding the needs of the customer and forecasting demand and supply,

this in turn has resulted in companies and industries with this ability to retain control in terms of consumer behaviour and power.

Shipping transport moves around 90% of the world's trade but in terms of managing information, its processes are considered decades behind other transport and logistics industries. Again, this could be drawn back to the instability of the industry throughout its history. The article "Big data boom in the shipping industry" states that the industry produces about 100-200 million data point daily between ports, couriers, social feeds, vessel movements and the rest of its operating network. Therefore, one can establish that there is an already existing network. The introduction of digitalisation and big data management would contribute to better and improved efficiencies in terms of route identification, port allocations and creating better links with couriers. Assisting everyone within the industry to improve without the entrance of new competitors.

Today's shipping environment faces challenges such as the fall of freight rates post financial crisis, oversupply in the market and the threat of external industries penetrating the market, which stem from external industry having growing interest in the current market. In addition, situations such as the 2008 financial crisis have led to major changes in the way shipping businesses conduct their business. The concept of digitalisation has unsettled the shipping and maritime industry for the past 5 years with the discussion around the topic continually growing and becoming more prevalent in operations. In the dynamic environment, today it is an unavoidable topic, heavily linked to the development` of the new industrial revolution, the 4th industrial revolution dubbed Industry 4.0. Compared to the earlier times in the maritime industry, it's almost impossible to think about maritime transport as just shipping as the movement of cargoes from port to port and vessels only as business activities are not as simple as they used to be. Today's business environment requires faster and more efficient services with increased competition demanding existing organisations to continually find means to differentiate themselves to remain in business. The current business environment has been pushing an agenda to change how shipping

organisations do business through the drive of integrating more digital processes and the adoption of new technologies to enhance the and expose the industry to more opportunities.

Importance of digital transformation

The increase connectivity accessibility has changed the business model today, distorting the lines between industries and organisations as well as the capabilities of these industries and organisations which has fundamentally changed the value chain of global supply chains. With certain segments of the supply chain having already been affected by the change from linear to platform model value chains, the structures have changed either eliminating existing participants or introducing new players into the chains such as aggregators, each taking their own margin, to fulfil the demands of their customers Lin et al (2009).

Digital transformation requires changes for both the central business processes of the organization as well as support processes (Lin et al 2009 ;Westerman et al. 2011). For example, whenever a customer uses a digital service instead of, or in addition to using the traditional offline services of the organization, it is possible to gather much more information about their behaviour and more easily customize the service the suit their specific needs. As an example of the requirements for support processes, the increasing and rapidly fragmenting customer interaction requirements make it very difficult for the organization to answer the demand with the limited resources available.

With this information, experts have concluded that digitalisation is more than a disruptive trend, but here to stay and become a permanent part of the way businesses conduct themselves in future. When not only considering the disruptive elements as maritime has to date but also consider the strategic opportunities and

importance of embracing this change to the industry, the bigger picture in the integration of the global service and supply chains and finding ways to continually create value throughout their operations. Poor understanding and analysis of the opportunities in digitalization have led to the industry only focusing on certain aspects of the concept which has led to the industry labelling the concept as a disruptor and a trend that wouldn't inevitably affect the industry in the long term. Some industry analysis has decided otherwise; that is, they have labelled themselves as futurists, considering digitalization as a big part of the future of maritime transport sector not only regarding the operational and technological side but the holistic standpoint of digitalization and digital transformation on different aspects of the industry.

Research Contributions

To clarify and understand the concept of digitalisation specifically in application to shipping and logistics in the maritime industry. In addition, to identify business strategy opportunities in relation to digitalisation and embracing the role of maritime transport in the 4th Industrial revolution.

The shipping industry has gone through minimal change since its inception back in 1956 which has recently attracted the attention of tech dominating companies such as Uber and Amazon. The growing interest of the technology sector has potentially created a growing threat to the industry. The shipping industry is not immune to the changes currently affecting today's business environment, digitalization has been noted as one of the most dynamic developments in our time, closely linking opportunities and risks. Current tech giants aim to destabilize the current shipping industry and reduce the current reliance on existing shipping companies through their aims at reducing their own operating costs and developing more flexible shipping services. Organisations such as Amazon aim to expand its current operations from not just being known as an e-commerce giant

but expanding its operations to decrease these costs by finding ways to reduce transaction costs and increasing automation and flow of information and services to their benefit, which has lead them to seek opportunities in the shipping industry. In an article by Condliffe (2016) organisations such as Amazon spend about 10.8 percent of its sales revenue on shipping, it would be a logical reason to want to expand operations through vertically integrating into shipping, and through this this Citigroup estimates potential savings of $1.1 billion per year for Amazon. Therefore, how could this potential threat of loss of income to the shipping industry be returned to the industry? Through the proactive reaction and adoption of digitalisation to current operations.

Currently, only larger organisations within the shipping industry have made investments into implementing big data management and digitalisation based business models, but for the industry as a whole to survive, the efforts need to be made by the smaller organisations that support the industry. It has become a talking point within the industry that a proactive stance needs to be taken and discussion is being had. From an article adapted by Lloyds list "what will save the shipping industry?" the discussion facilitated by 9 industry experts and leaders individually acknowledged that the industry needs to make specific necessary changes in order to survive, from the use of digital investments to assist with overcapacity on the supply end, to assisting with controlling emissions from the industry. It has been acknowledge that the trend towards big data management and digitalisation is very relevant for the industry to survive and that the problem with the current industry is its lack of connectivity and ability to keep up with the continually changing business environment. Yet the industry leaders need to ensure that the discussion does not just end at realising what the problem or potential solution to their problems/threats and begin to implement the solution before organisations from outside take over.

Structure of Thesis

The chapter following the introduction addresses the research questions that intend to manage the structure of the thesis. Followed by the methodology the thesis intends to follow.

The following chapter addresses the theoretical framework of the research, which begins with a brief overview of the history of maritime transport. Within the framework, the research will address both business strategy in maritime transport as well as the proposed digital transformation strategy. Each strategy aligned with a distinct characteristic which will be addressed with the strategy.

The next chapter will review the distinctive characteristics of the maritime transport sector, which includes understanding the sectors that make up maritime transport as well as the industry analysis. This would then be followed by the reviewing of developments in the markets and understanding the structure of the container sector in relation to digital transformation. Finally, the thesis will conclude by answering the questions asked in the first chapter.

RESEARCH QUESTION

The fundamental objective of the research is to identify the reasons for digital transformation in the container shipping sector. This will be done through the understanding of literature and key concepts used to build up the sector to what it is today and performing industry analysis to estimate the position of the market in comparison to global industry dynamics.

In addition to better understand the reason for digital transformation, a review of the chosen industries characteristics along with recent trends in industry dynamics have been taken into account. In order to do so, it is required to ask research driven questions to continually align the research. Due to the limited resources available in addressing the topic, the main research question will be answered through the addressing five sub questions.

Main question: *what are the fundamental reasons for digital transformation in the container shipping sector?*

1. What is digitalization and how this would affect the existing business strategy of the container shipping sector?
2. What are the driving forces behind the digitalization of the industry?
3. can the existing shipping industry market hold survive the effects of digitalization?
4. Should the concept of digitalisation be considered a disruptor or a potential enabler for the maritime industry?
5. What challenges face of digital transformation in the maritime industry?

METHODOLOGY

With limited resources directly dissecting the topic in relation to maritime transport, the literature has been limited to articles and journals published in the last 10 years with the cut off year as 2007. General academic literature has not been limited to a specific period for reasons that will be justified later. Priority has been placed with practitioners and authors focused on the topics centred around digital transformation topics.

Secondly, as previously highlighted, with limited literature directed at maritime transport in relation to digital transformation, the technique used to find relevant literature was to search using a wide assortment of applicable keywords. Searches for research would be guided by a combination of key terms taken from the questions, such as integration, innovation, digitalisation, digitisation digital transformation, maritime transport, and strategy. The main search engines would be the WMU library and google scholar.

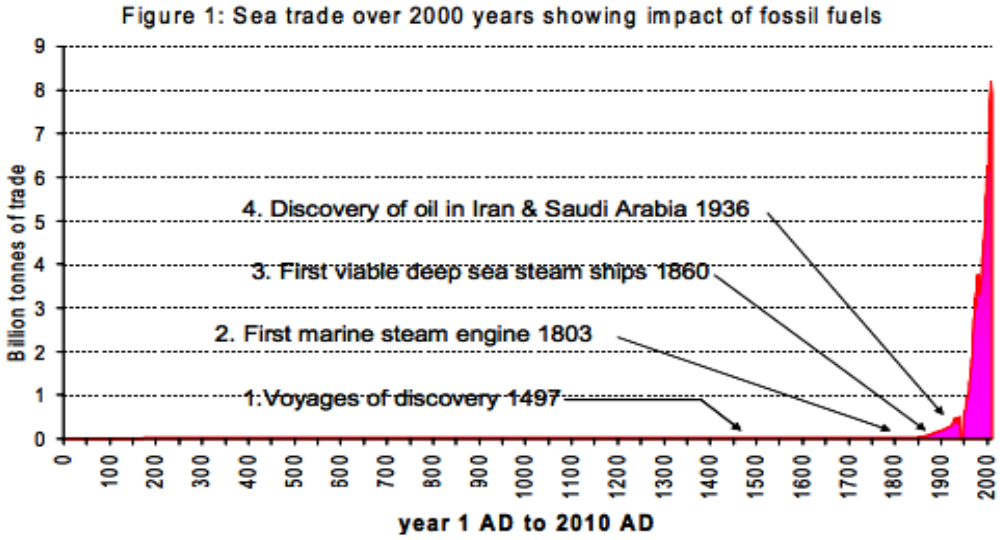
Thirdly, the literature review will be structured beginning with a glance of the history of maritime transport and the changes experienced followed by answering a series of questions, What, Who, When, How and Why? With each section being made up by the specific combination of the key terms in an attempt to fully address the interests of the research.

THEORETICAL FRAMEWORK

4.1 History

Shipping has an extensive history with over 5000 years of documented history but only in the last two centuries has sea transport cemented its role in the globalisation of the world economy (Stopford, 2010). In the early 1800s, ships where constructed by wood and powered by wind, relatively smaller than trade vessels today at 100-600 tons. Through the years as will be further highlighted, sea transportation has not only been affected by socioeconomic factors but also developments and discoveries of fossil fuels and technological innovations that changed the ways of shipping, as seen in **Figure 4.1** below.

Figure 4.1.: Sea trade over 2000 years showing impact of fossil fuels



Source: (Stopford, 2010)

As ships grew bigger distances travelled became longer and with time, and technical improvements such as navigational tools required more accuracy with the transition from inter-regional trade to global trade. The limitations to global trade was the size

and speed of the vessels at the time of the first industrial revolution. **Figure 4.1** shows how the discovery of fossil fuels has also changed the propulsion of vessels and contributed to the development of marine transport, which can be summarised in the **Figure 4.2** below.

Figure 4.2: Development of Marine transport 5000 BC to the present

Table 1: Development of marine transport technology 5000 BC to the present

	1	2	3	3	4	5	6	7
Date	**Primary Energy Source**	**Hull Materials**	**Hull Construction**	**Main Engine**	**Propulsion unit**	**Navigation technology**	**Inland Transport System**	**Shipping System**
5000BC	Muscle	Wood	pegs		Oars	Astro	Road	Tramp
	Wind	nails rope oakum pitch	nails rope		Sail	Compass Backstaff (1) Chronometer (2)		
1780		copper sheath	fasteners					
1833	Coal	Iron		steam 1	Paddle		Canals	
			rivets caulking	steam 2	Screw		Rail	Liner Tramp
1870		Steel	Wire	steam 3		Sextant (3)	Truck	Passenger
		Aluminium GRP		Turbine		Radio	Air	
1913	Oil	SPC	welding	Diesel				
1950	(Nuclear)					Radar		Bulk Container Specialized
	(LNG)					Satellite		
2000								

Notes
1 Backstaff which relied on the shadow cast by the sun, was developed in 1720
2 Chronometer developed by John Harrison 1759
3 Sextant developed about 1870 as improvement of Hadley's backstaff. Allowed accurate measurements from heaving deck of a ship at sea.

Source: (Stopford, 2010)

The use of different fuelling methods and sources not only contributed to the efficiency but the cost of marine transportation. While providing a cheap, reliable and efficient transport source the shipping industry assisted in converting the world into a single market place (Stopford, 2010) with shipping playing a crucial role in the global

economy back then. With continual external factors affecting the maritime sector, the business cycles are getting longer and challenges faced by the industry are growing. In 2010, Stopford suggested that "*if shipping stopped for 3 months, so would modern life as we know it*" and this would be as a result of the evolutions in shipping and its vessels from size to efficiencies which have brought down the cost of shipping but this didn't take into account macro-environmental factors that influence the industry today.

The shipping industry now

Whilst Micro-environmental factors such as improvements in efficiencies, cost management and establishing economies of both scale and scope have contributed to the low cost of shipping which has contributed to the industry's concept of shipping is indispensable, the industry had not taken into account the macro-environmental factors. This is because in that time industries had clear definition and little to no overlapping happening between them. With the development of concepts such as the internet of things, increasing connectivity and changing the way organisations conduct themselves. The rapid developments in technologies have and will continually also interrupt the current business models employed today. From the literature reviewed, it may be concluded that the previous business strategies employed by shipping lines would be strategies that focused on either the lean or agile approach mainly through integrations, and mergers and acquisitions. Integration has assisted shipping lines in growth strategies with the aim of expanding the range of services to their customers, with the aim of keeping external costs low by integrating them into internal operations as well as adding to the organisation agility through the expansions of services. Their main purpose of integration projects would be redesign and optimise an organisations supply chain to support the businesses core business. These activities have been distinguished through the terms 2pl, 3pl and 4pl providers, which the more integration being a higher/more services providing supply chain.

But while integration may appeal to both strategies at the same time without limitation may be detrimental to cost management by not limiting the organisations offerings to customers. Leaving space for increasing costs for maintaining services that customers don't use. Mergers and acquisitions have also played a significant role in maintaining the structures of the existing alliances but may be considered more of a power strategy between the lines. The industry has been known to use bigger is better strategy seen through economies of scale, which this trend can be seen through the significant growth in vessel sizes over the years. While maritime transport is a services business, literature suggests that the strategies employed by the industry focuses on strategies employed in manufacturing based sectors. With concepts and jargons such as the focus on supply chain management rather than a focus on service chain management could lead to significant changes in the industry. This significant shift in thinking is referred to as cognitive diversity. Using the correct way of thinking to solve problems faster could be a solution for the industry to assist in the turmoil that has followed it. The previous and current strategies employed have provided for strategies to treat symptoms rather than the actual problems that organisations in the industry which this paper aims to address.

The future of the shipping industry

In assessing the future, looking at the theme from the 2016 world maritime day, "Shipping: indispensable to the world" but with the continued acceleration in connectivity and expansions of global supply chains and with it supply technologies that have changed the way of doing things, one needs to question whether shipping is

truly indispensable to the world. With this, questioning what is truly disruptive to the maritime transport industry.

Business strategy and it strategy

In revisiting one of the purposes of this research, would to review a digital transformation strategy for the maritime transport sector aligned with the objectives of industry 4.0. in the previous chapters, we have discussed both the digital side and the industry 4.0. in order to efficiently and effectively implement digital transformation in relation to business activities this relationship would have to be facilitated or managed through a plan or what is referred to as a strategy. Specifically, for the purpose of the research we refer to a business strategy. Strategy along comes in the form such as corporate, business and functional strategy. Corporate strategy focuses on establishing what business to be in, business strategy focuses on how to compete while functional strategy focuses on supporting business strategy. Since the purpose of the research does not single out a specific organisation as well as the research focusing on improvement on how to compete with the changes in the existing industry while seeking strategic cooperation throughout the industry and will therefore focus on business strategy. The business of maritime transport is to provide a service to its customers, Minztberg therefore relates the term by defining it by "*how shall we compete in each business?*" in trying to understand and align this definition to the research, it is to establish a general operating strategy and to facilitate health competition how would organisations customise themselves to compete as individual businesses in one industry.

Linking back to the original statement, writers such as Watkins (2007) define business strategy as;

> "*a set of guiding principles that, when communicated and adopted in the organisation, generates a desired pattern of decision making. A strategy is*

therefore about how people throughout the organisation should make decisions and allocate resources in order to accomplish key objectives".

While Mintzbergs definition highlights the importance of competition, Watkins definition brings it back to basics, and focuses on core issues that need to be dealt with specifically aligning resources with objectives, which from the industry analysis of the industry is a persistent issue. In order to fully compliment the focus of strategy with natural competition, (Henderson, 1980) quote *"all competitors who persist over time must maintain a unique advantage by differentiation over all others. Managing that differentiation is the essence of long-term business strategy"* and in todays business environment it can be assumed that the differentiation factor may be an organisation or industries ability to adapt to the changing times, linking business to Darwinisms adapt or die theory. This is imperative in understanding the future role of maritime transport within Industry 4.0.

In the context of digital transformation and the overlapping of industries of today, an interesting perspective to business strategy would be the concept of emerging strategies (Mintzberg et al, 1999). Concurrent with the challenge faced by shipping today, the penetration by external forces, has contributed to the formulation of these new innovation based strategies. With shipping's concern revolving around the delivery of goods and services required by customers, business strategy is crucial in facilitating the identification of opportunities, provides for an objective view to solving business problems while giving a framework to improve internal and external collaboration in addition to numerous supporting attributes from business strategy. (Lun, Lai, & Cheng, 2010) Walker et al 2003 identifies that a well structured strategy for shipping incorporates five key components:

1. *Scope* referring to the strategic domain or industry including market segments
2. *Goals and objectives* focused on the intended levels of accomplishments

3. *Resource deployment* denotes the management of resources aligned with achieving the underlined goals and objectives.
4. *Competitive advantage* considers the importance of competition awareness, indicating how an organisation intends to compete, either through maintaining sufficient employment of vessels or through the additional services i.e. integrated services.
5. *Synergy* referring to the compatibility of resources, an existing example may be noted through the collaboration of entities in alliances.

Integration

In taking into consideration the changes in both the maritime transport sector and the evolutions of the industrial revolutions, the concept of integration along with macro-environmental such as globalisations, deregulation and technology factors have played a crucial role in the changes in which have restructured the shipping industry. While maritime transportation is considered a global business, with the factors mentioned previously, customers are looking to a bigger picture beyond straightforward shipping. Previously logistics organisations operated as separate entities but with globalisation, the concept of global logistics grew, changing the business structures with the purpose of adding value through freight integration within the supply chain. As a result, the changes of the maritime industry, maritime logistics stem as resulting trends of integration.

To further understand the role of integration regarding the research topic, with maritime transport activities involved in the global supply chain, supply chain integration, a key component of supply chain management which provides both an internal-external perspective to understand it is used (Chen, Daugherty, & Landry , 2009). The main drivers of integration are note by: the information revolution; the increased level of global competition which in turn has created more demanding

supplier and customer driven markets; the emergence of new types of inter-organisational relationships (Handfield & Nichols, 1999). Together with (Vickery, Jayaram, Droge, & Calantone , 2003) highlight two aspects in their conceptualisation of an integrative supply chain strategy, firstly the existence of intgrative information technologies and secondly the existence of practives that strengthen linkages between organisations occupying different positions in the supply chain. Even in the periods before connectivity has become a crucial aspect, the topics highlighed in relation to integration play a important role in the effective implementation of digital transformation strategies within maritime transport. To be discussed later specifically the container shipping sector in chapter 6.

In discussing integration in the business context, we refer to vertical and horizontal integration, strategic alliances of different forms (Panayides & Wiedmer, 2011) and mergers and acquisitions, which in itself has been used as business strategies in the maritime sector as an expansion strategy. Within the maritime transport industry, horizontal integration takes place in the form of alliances, mergers and acquisitions, this has contributed to the established 3 major alliance groups known today namely 2M, The Ocean Alliance and The Alliance. Each alliance controls a significant amount of market share, this type of strategy has allowed organisations to maintain a power based model used to grow therefore resulting in a bigger is better type situation as well as a “too big to fail”.

The way maritime has used the horizontal type strategy has raised questions on the cartel aspect of maritime business as this type of strategy has limited the barriers to entry in the industry. The alternative, to vertically integrate is to merge two businesses involved in different parts of the supply or service chain. Whilst horizontal integration has been the popular option within maritime, vertical integration has gained traction due to the change in the competition structure and provision of new service options. (Altuntaş, C., Göçer, A. 2014) writes about integration in the maritime context is the combination of the traditional maritime transport industry activities with logistics

activities to design optimal shipping networks and support the maritime transport chains while taking into consideration cost implications and environmental impacts. He attributes this to the high interdependent nature of the activities between maritime transport and the pre-and post logistical activities that establish the network. Competitiveness in the maritime transport industry structure has changed, shipping lines no longer compete on the basis of competing against each other as shipping lines but with the overlapping of industries breaking down barriers to entry into the sector organizations would have to find alternative ways to compete and remain relative. The reason behind understanding integration is within the maritime context, it has mostly been studied in the field of container shipping. This is because the goals, operations and activities have been more relavant to those of logistics, hence the importance of understanding digital transformation within the container sector.

Digitalisation, digitization and digital transformation

In the era of information, it is imperative to ensure the right information is allocated correctly and understood correctly. While organisations operate in the era of information and in a digital world. There are many misconceptions around concepts linked to the digital world. This may be attributed to different levels of or patterns of thinking and understanding and therefore it is important to constantly establish mutual understanding of terms and concepts in order to achieve a mutual goal. From the analysis there is an existing misconception that technology is digitalisation, whilst technology is merely a component of digitalisation. The other important consideration in applying these terms it to remember that all three terms may have different meanings depending on the context they are being used in. this paper would also establish the context of use for the terms applicable to the maritime transport industry. (Lorange, 2017) tends to link the concept of digitalisation straight to information technology

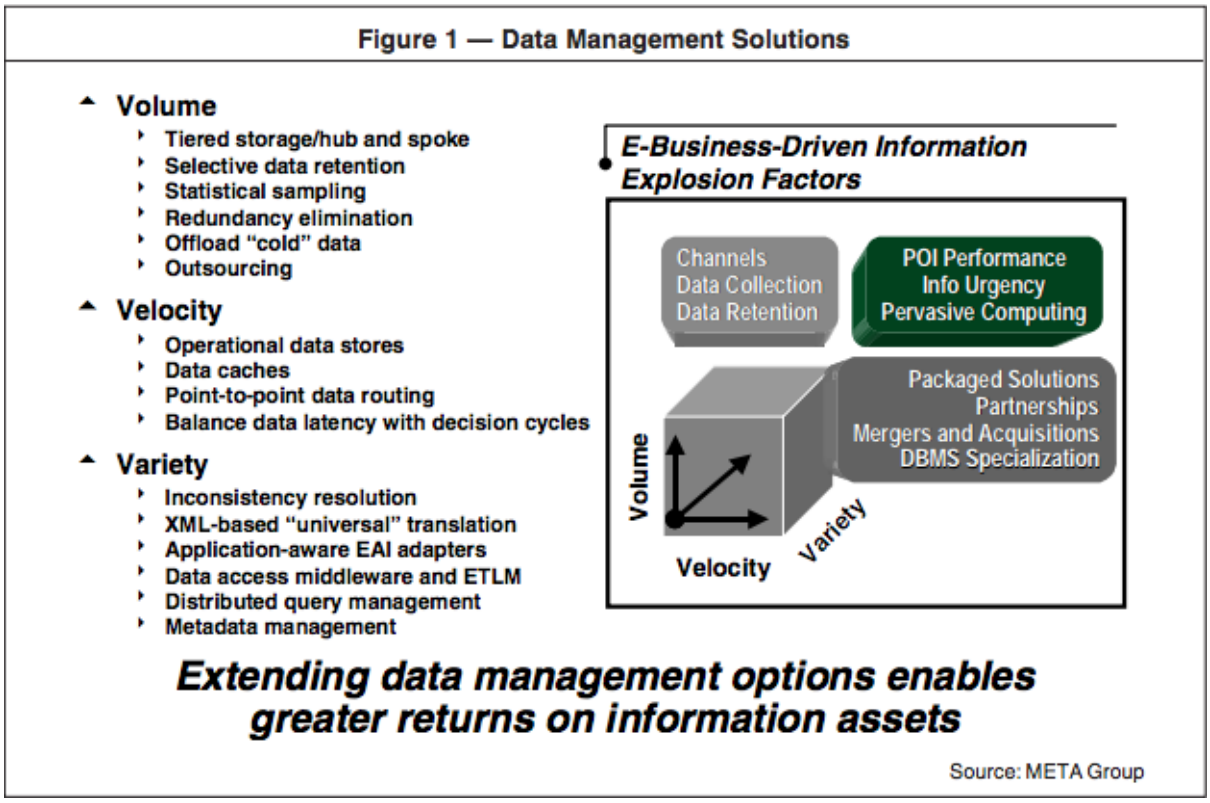
companies, with the idea that they intend to disrupt or take over the maritime industry whilst futurists such as (Adamson, 2017) believe that there won't be a maritime industry to turn to if the industry does not embrace digitalisation as a whole. This clash of understanding may be attributed to what each author understands about the terms or their own personal perspective of what is happening in the business environment. While reports that have significant impact in the maritime world such as the Global Maritime trends report label digitalisation as disruptive and solely focus on the technological aspect and not a holistic viewpoint, it is understandable why people in the industry would the same.

Driver of digitalisation is performance, lack of performance has led to disruptive technologies with the potential of impacting the industry negatively. According to (Brennen & Kreiss, 2014) digitalisation can be defined as the "adoption in use of digital or computing technology by an organisation, industry or country". In saying this, the world around us today has become more accessible regarding connectivity. At the same time (Brennen & Kreiss, 2014) as state that the terms are closely associated and used interchangeably while also believing that analytical value can provide distinction at the same time between the two terms. Literature describes digitisation as a process of creating a digital version of things, not necessarily replacing the one with the new but creating a backup version which would be easily accessible. Therefore, from this definition digitisation can be the digital copy of something or defined as the process of converting something to digital format in which it can also be described as a synonym for automation. With a more broader meaning, the business dictionary definition of digitalisation states it as the integration of digital technologies into everyday life by the digitization of everything that can be digitized. Because the two words digitisation and digitalisation are only differentiated by 2 letters, people tend to think you can use the terms interchangeably, yet the definition from the business dictionary reveals otherwise. (Amarnath , 2015) describes digitalisation as the management and correct application of big data or of a collection of digital resources. While his definition of digitalisation may not be the same as other literature

above, his view may be more business orientated while other literature views digitalisation on a more general base. (Amarnath , 2015) agrees that digitisation is a process of conversion and creating a collection of big data. the main aspects from the terms is processing and management, and technology only plays the role of facilitator. Therefore, where does the misconception of the two terms being technology come from? This will be further discussed in the next chapter.

Within digitalisation, there are a number of key focus points such as Big data which is the result of the process of digitisation as indicated previously. Whilst it is still a relatively new term this concept has gained traction since the early 2000's following the Dotcom crisis. It is described as the gathering and storage or large volumes of information to eventually be analysed and articulated. The concept itself is not new, as organisations including and beyond the maritime sector have been storing this type of information, maybe not on a digital platform but maybe in a document warehouse for a different purpose such as auditing. The term big data came with the processing of digitising this already existing information to be stored in a centralised platform or what can be referred to as a data warehouse which has heavily been supported by additional concepts such as the internet of things and technological developments. Industry analysist such as (Laney, 2001) summarises the definition of the term big data using the three V's, Volume, Velocity and Variety. While (Laney, 2001) based his definition of big data based on e-commerce business models as seen in the figure below, with the overlapping of industries and retail and e-commerce industries such as Amazon and Alibaba having potential to penetrate the maritime industry, this model established by (Laney, 2001) is relative to the maritime industry today.

Figure 4.3: Data Management Solutions



Source: META Group (Laney, 2001)

The volume aspect of the (Laney, 2001) definition of big data refers to the collection of data from various sources, any data that goes through the organisation and that is relevant. As previously highlighted, this has historically been done but because of the limitations to storing physical data, the collected data was selective but with technological developments platforms such as Hadoop and cloud computing allow for organisations to continually stock large amounts of data digitally to be called back when necessary. The velocity aspect relates to the speed in which data streams in which may also relate to the frequency in which data is loaded. The speed and frequency would be determined by the means of data transmission, from the use of sensor, smart tagging and RFID of manual digitisation of documentation would have different effects of the speed in which the data is processed. Lastly variety is about the different formats in which the data may be presented in ranging from structured, numerical, unstructured documentation, videos, emails financial etc. analysts such as (Laney, 2001) has been criticised for only looking at one aspect of big data, the storage

side of it whilst organisations such as Gartner look at big data from both perspective, storage as well as processing. Taking into consideration (Laney, 2001) idea of the three V's, (Sicular, 2013) believes the definition of big data is misunderstood and defines big data as "high volume, -velocity and –variety information assets that demand cost-efficient, innovative forms of information processing for enhanced insight and decision making" Gartners (Sicular, 2013) employs this definition of big data not only to establish a common ground between themselves and their clients but also use it to identify both the challenges and opportunities available with managing big data. through their process, they have found ways to solve problems by making use of all data to establish patterns and provide new insights from data that previously wouldn't get a second look at. The most crucial aspect that Gartner takes into consideration unlike (Laney, 2001) is the cost-effective, innovative forms of information processing which they have added in their definition. Ultimately big problems require equally big solutions and Gartner strives in providing these solutions but extensively taking advantage of all data available, the larger the resource pool the greater the potential for multiple solutions but it is empirical to ensure quality and standard as well as cost while operating in this manner. Last, Gartner considers the last addition to their definition as the most crucial element to big data, which they believe differentiates themselves from other definitions. The insight and decision-making aspect, in which their goal may be considered as means to find value in the efforts put to not only to gather, but store, analyse and transform the data to viable information to add value.

Previously, its noted that big data today wouldn't be as manageable without the concept of the internet of things (IoT), (Rouse, 2016) defines the IoT phenomenon as the development of interrelated computing devices, mechanical and digital machines that are provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human computer interaction. In essence, without IoT, the velocity aspect of Laney's big data concept would not be viable. IoT has allowed for the growing connectivity that is changing the world we know today, not only in the

business facet but in everyday life. With its complexity, some literature suggests it has simplified life whilst other literature argues it has disrupted environments resulting on an over reliance and dependence. While some literature may argue that humans have become dependent on IoT, authors such as (Adamson, 2017) and (Ashton, 1999) both from different periods have said that the internet is dependent wholly on human beings for information.

Linking everything together is technology development, it has allowed for the creation of computers and everything that followed with it. With technological development came changes and the evolution of innovation too as highlighted previously. Technological development has followed with all the evolutions highlighted and has developed along with the change in mind-set of human beings and what is considered cognitive diversity.

In relation to the business environment, without information, there is no market but this vital information must come from somewhere (Blum, 2017). This information is initially data that would be gathered from customers, processed and converted into "useable" information and from this information, strategic business decision may be made. One could resolve from the previous statement that two crucial elements of digitalisation and digital transformation is considering two basic factors, namely the customer and data and using this along with the technological advances available to enable organisations and industries to optimise performance and enhance efficiencies across their value chains. Unfortunately, the apprehensive culture within the industry has not allowed the industry to fully understand the concept of digitalisation, only understanding the concept through the technological aspect and overlooking the knowledge management characteristic to digitalisation, remaining with a one-sided view point which would only provide for minimal gains. In this sense, the concept of digitalisation for the majority in the maritime sector has remained a buzz word rather than a concept of consideration and this assumption may be supported but the limited exposure of the concept in major publications with large exposure in the industry.

Gartner (Sicular, 2013) uses digital transformation as a synonym to digitalisation, going back to the definition of digitalisation provided earlier, in addition to it, the concept is used to create revenue, improve business, transform business processes and not simply automating them and create an environment for digital business, where digital information is at the core and the process of achieving this may be referred to as digital transformation.

Literature from (Westerman, Bonnet, & McAfee, 2014) categorises the strategy of digitalisation/ digital transformation into three categories with a total of nine aspects focused on a holistic approach in apply the strategy. In analysing their approach to digitalisation as a business strategy, in implementation, it aims at moving a business or industry from a less lean approach to a more agile approach suitable for today's dynamic business environment.

4.6.1. Transforming customer experience

Customer experience makes or breaks an organisation or industry, this category focuses on firstly, understanding the customer revolves around finding out what the customer wants and needs through data collection. This building block will be further addressed in this research as it has played a major role regarding disruption In general in the maritime transport sector. The relevance of understanding the customer relates to its analytical capability to understand the customer, which is the data/big data aspect of digitalisation and digital transformation, for example, the use of behavioural analytics to understand supply and demand to fully optimise resources. Secondly growing the top-line centred around the use of technology to facilitate the relationship between the customer and the business/industry and lastly customer touchpoints which revolves around the transparency and connection between the business/industry and its customers. The theme of transparency will be further elaborated on in later discussion.

4.6.2. Transforming operational process

The second category focuses on identifying the strengths and weaknesses of internal processes and transforming them through the process of digitisation, enablement and performance management. The 3 aspects that are of importance to this category are process digitisation, worker enablement and performance management. The successful employment of all three requires detailed assessment of micro-environmental factors. Whilst machinery may be automated the holistic process it may be involved in may not, continuous commitment from supporting staff as stated by (Adamson, 2017) and (Ashton, 1999) that humans play a crucial role in the entire process. Lastly continuous assessment plays an important role in ensuring that goals are aligned.

4.6.3. Transforming the business model

The last category aims at looking at the holistic effect of the previous categories on an organisation. Each aspect and category has a cascading effect on the other and in assessing the business model it is ideal to look at the bigger picture. As continuously highlighted, the business model has changed and will continue to change with the advances of all the concepts discussed previously. Within this framework, (Westerman, Bonnet, & McAfee, 2014) had established that companies are not only changing how their functions work, but redefining how their functions network and expand the margins of the organisation. The three aspects of this category focus mostly on the opportunities available both internally and externally as well as benchmarking against similar organisations to assess implementation of the transformation strategy. This category holistically looks at the macro-environmental aspects of digital transformation regarding digitally modified businesses, looking at what is happening in the business environment and the effects on organisations that have modified. Secondly, new digital businesses, looking at what is available to the market in terms of digital products and what opportunities would be available in relation to gaps in the digital market. Potentially looking at customisation opportunities to differentiate themselves. Lastly digital globalisation, viewing digital transformation on the wider

scale, industry scale rather than sectorial. From this perspective, one can see who has benefitted from what and what concepts are more viable than others. For the purpose of the study, the discussed digital transformation strategy would be revisited as a component in the theoretical framework for the research to be elaborated on in the fourth chapter.

Currently based on the aspects noted, the maritime transport industry has focused its digitalisation or digital transformation strategy mostly on operational processes mostly on a safety orientated activities. This assumption can be supported by the trend analysis report, the global maritime trends 2030 which highlights application of digital transformation within the naval sector. In analysing the industry, it can be noted that coast guard sectors, for example the Hellenic Coast Guard has embraced digital transformation through the use of integrated platforms through the use of AIS data to strategically plan their operations.

Regarding the remaining two remaining categories, transforming the customer experience and transforming the business model. These two categories are the basis of this research. From a joint seminar held at the World Maritime University along with the Korean Maritime Institute, a question was raised to speaker Peter Lorange whose discussion was centred around Innovations in Shipping with emphasis of a Model for value creation. In the panel discussion, a guest raised the question "who is the customer?". Literature by (Adamson, 2017) touches on a similar discussion, stating that shipping has lost track of its "real" customers and has "established" the IMO as its customer, focusing solely on building vessels that satisfy the specs of IMO and forgetting to consider the customers' needs. In losing focus in who the customer it serves is, has resulted in the disruptions that the industry faces today. The leader in the industry has identified this discrepancy,

There is also a misconception that digitalisation means less people and that the idea is for machines to take over and humans would be redundant. This assumption is wrong,

and those who understand know that people play a crucial part in the digital transformation process. People not only provide the data/information that is needed but for digitalisation to be efficient the most crucial element is ensuring the correct data needs to be used.

Innovation

The definition of the concept "Innovation" has changed over the years and also dependent on the industrial use of the term. Historically the term has been used more as an accusation rather than an accolade. Dating back to the 13th century the term innovation was used in the law context for the renewal of contracts but not seen as a term for creation. Later in the 16th and 17th centuries, the term innovation was used in relation to Puritanism, relating it to purity in the religious context and not in the most positive light. Used to identify church officials as innovators in Henry Burtons campaign against the churches, which later resulted in his ears being chopped off and life imprisonment. (Ma, 2012) attribute the evolution of innovation to the similar evolution of humanity. That innovation has changed with the complexity of thinking of humanity, that innovation is directly correlated to ideation. With humanities evolution based on three stages, namely hunter gathering, the industrial era and lastly the information era, literature suggests that innovation has followed a similar pattern namely the "before computers" similar to the hunter gathering, the use of artefacts and simplicity was used to solve problems and make decisions. The next era, "after digital" like the industrial revolution, the invention of computers changed the ways of doing things. Along with computers came along innovation tools such as mind mapping. There was a shift from the basic way of doing things to building brain tools. Like the industrial revolutions discussed in the previous sections, with the increase of industrialised tools such as factories and the conveyor belt type systems, the second wave of the innovation evolution came with idea factories. Lastly, the current stage of innovation, not only looks at problem solving but provide means to invent, and

fundamentally create better or alternative solutions. One could state that the previous two stages of innovation can be linked more to science and the current state attempting to find a balance between art and science. Previous ways could be labelled as treating symptoms rather than the actual illness whilst the current means of innovation, partnered with cognitive diversity reaches beyond treating symptoms and targets the underlying problems faced.

The maritime industry is no different to any other industry that contributes to global trade under the aspect that it is businesses facilitating trade. With this, digital transformation is affecting a number of different industries involved in global trade it is then up to the industries to determine what to do with the road ahead and with the current and potential capabilities of the industry determine whether the trend or possible future way of doing business would be an actual disruptor or enabler to the industry.

DISTINCTIVE CHARACTERISTICS OF THE MARITIME TRANSPORT SECTOR

The purpose of this section is to detail what was discussed in the history of shipping and elaborate on what we mean by the term shipping in addition addressing the focal point of the study.

Shipping is concerned with the transport of cargo between ports by ships. (Lun, Lai, & Cheng, 2010). Shipping as a derived demand has been considered one of the world's most international industries, overtime becoming increasingly dynamic and complex in nature through concepts such as economies of scale, network based management and the adoption of technology for efficiency and effectiveness. While shipping is generally a broad term and can be used to describe this activity in any mode of transportation, the research will be focused on shipping in the perspective of maritime transport.

In looking at maritime transport markets, "*it must be possible for buyers and sellers to communicate with each other and to make meaningful deals over the whole market"* (Lipsey, 1993) Initially the market was undivided and not specialised, but with the increase in trade, the expansion of the market and increased economic motivation for higher levels of productivity is when the need for specialisation grew with the customisation of vessels. Bringing us to todays in which markets have been distinctly segmented and one cannot refer to shipping particularly in maritime transport as one activity. The segmentation has been developed through the differentiation of vessel types, trade requirements and geographical location.

The maritime transport sector is segmented by type of cargo carried by different types of vessels as well as the shipbuilding and demolitions markets. Majority of the industry reports provide a general overview of the industry as a whole and perform analysis

based on the different markets within the maritime transport sector. For the research, analysis would be performed on a holistic sense as digital transformation would affect all markets within the maritime transport industry in regard to business strategy implementation, further modifications to "personalise" the business strategy approach to the market may be for further research.

The purpose of an industry analysis is to analyse a specific industry, see its past trends, demand-supply mechanics and future outlook (Nigudkar , 2016). There are six steps to performing an industry analysis which involve the reviewing of available reports, ensuring that the approach is driven by the correct industry, assessing the demand and supply scenario of the selected industry, analysis of the competitive scenario, reviewing of recent developments and lastly focusing on industry dynamics. This process will allow us to further understand what is happening in the industry and establish the role of digital is the current state of the industry through the analysis of the macro and micro-environment of the industry.

This process involves the reviewing of information on current economic market conditions, there are two types of ways in which an industry analysis can be performed, quantitative and qualitative. Quantitative following a more mathematical process used to analyse a specific part of an industry whilst qualitative method looks at reviewing industry information to make judgements based on the information reviewed. The benefit to performing industry analysis is to gain specific knowledge regarding an economic marketplace, establish value propositions and gaps in a market place beneficial to both existing and potential players in the industry.

The shipping or maritime transport industry, industry reports have been written by various entities in the general industry. Mostly by associations affiliated to the industry such as ship owners' associations, registries, auditors and individual industry analysists with different perspectives. Mostly based qualitative information gathered from the industry to establish the trends and scenarios in the industry, with some

focusing on specific segments or modes of transportation, giving a perspective of their general overview and outlook of the industry and the outlook of the Norwegian associates aren't the same as those of the Danish and the same goes from auditing houses to financial institutions.

Most current industry reports begin with highlighting the struggles the maritime transport industry has been through. For the analysis, the research will focus on a handful of carefully selected reports which focus on various aspects of the maritime transport sector and that will also provide for different perspectives, written by different organisations in and involved internally or externally to the industry. The most notable report would be the UNCTAD review of maritime transport report published annually since 1968. The report claims to provide an analysis of structural and cyclical changes affecting seaborne trade, ports and shipping as well as statistical information to support. It's said to provide data in every issue about seaborne trade, emerging trends affecting maritime transport, fleet ownership and registration, shipbuilding and demolitions, freight rate conditions, shipping connectivity, port traffic, regulatory developments and bonus topical issued covered in a special chapter. The other reports stated in the figure below, were also used to perform the industry analysis but are written from perspectives of the entities that wrote them allowing the research to be more objective.

5.1 COMPETITIVE SCENARIO - PORTERS 5 FORCES

To accurately assess an industry, it's imperative to understand the industries competitive structure. Michael Porters 5 forces model has been the established

framework used to assess the competitiveness of entire markets used to provide a global overview, rather than detailed business analysis techniques (Hanlon, 2016). In addressing each force to determine the level of limitation or power, certain questions need to be addressed. Essentially the model assumes that profitability or return should be constant across organisations and industry, however in reality different levels of profitability or return would be varied due to different structure. As a result, industries or organisations have used this model to identify gaps and edge over competitors and to further establish untapped potential aligned with the interested within the industry or organisation.

5.1.1 Barriers to entry

i. Threat of new businesses starting in the sector?
ii. Ease of start up?
iii. Rules and regulation?
iv. Finance?
v. Barriers to entry that give greater power?

The business cycle history has previously lowered the barriers of new entrants in the time when freight rates are low, subsequently lowering the price of vessels in the market allowing opportunities to purchase. With the current cycle which has been prolonged, the biggest threat regarding the starting of new businesses has come from outside of existing owner base in the industry. The threat has come from external industries attempting to penetrate the shipping industry with the wave of digitalisation. To quote Michael Hansen, the global sales head at A.PMM, "bad services results in disruption in markets". Shipping is a capital-intensive industry, therefore ease of doing business is relatively high, this has increased since the 2008 financial crisis which has limited accessibility of funding. Previously funding was based on trust and reputation which was sufficient to grant loans but with the crisis, banks have become increasingly wary, resulting in a shift from traditional financing structures and zones with a gradual shift from Europe to the East as major financing hubs. Changes in the industry has also

changed structures of alliances to control power. To conclude, in today's business environment the barriers to entry may be considered as high.

5.1.2 Supplier Power

i. How many suppliers in the market?
ii. Control of prices?
iii. Number of suppliers' influencing price?
iv. Supplier power?
v. Switching costs?

As highlighted, suppliers have heavily been affected by the cascading effects of the general market, it the market doesn't do well the suppliers don't do well. In summary, the number of suppliers in the market is relatively high, with limited control over the price as the price fluctuates with freight rates and not production levels. Supplier influence is high in relation to demand of quality as per classification and switching costs are low. With this it may be concluded that supplier power is low.

5.1.3 Threats of Substitutes

i. Availability of substitutes or alternative means?
ii. Level of outsource?

In discussing substitutes, we refer to alternative means in which customers may receive the service they require in the form of other industries, in which the quality of service provided by the maritime transport sector come into question. Referring to what Michael Hansen said. In the past and currently this has introduced the concept of disruption in industries. With the new wave of technologies and means of doing business have led to the growth of substitutes and alternatives from the norms such as air and land transport, such as drones and 3D printing. In conclusion, the threat of substitutes is high.

5.1.4 Buyer Power

i. How powerful are the buyers?

ii. How many are there?
iii. Can customers drive down cost?
iv. Do customers dictate terms?

As previous studies have shown that shipping is driven by the global GDP or world trade, bringing us down to demand and supply, with buyers controlling the demand side and shipping the supply side regarding the service provided. Shipping is also referred to as a derived demand, which is defined as the "demand placed on one good or service as a result of changes in the price for some other related good or service". The buyer or customers as considered the strongest factor in shipping based on the concept of derived demand. In the case of shipping or maritime transport, customers would be considered in the form of importers, exporters, clearing agents, freight forwarders or manufacturers. In this case, depending on the demand and availability of supply, changes in demand do affect the price of the services provided by maritime transport. While competition in the industry is relatively high, customers will take into consideration quality of the service more than the price, this is because with the high numbers of competition, switching costs are relatively low for the buyers. In summary, the bargaining power of the buyers is high.

5.1.5 Degree of Rivalry

i. Level of competitors in this sector?
ii. Competitive situation?

Within the maritime transport sector, rivalry does exist just like any other industry. This can be seen through the structures of the alliances in the industry. Intensity of rivalry has previously been linked to profit margins, Michael Porter indicates that rivalry has a negative impact on revenue, (Beech & Macintosh, 2012) highlighting that markets with little to no competition pose more favourable market conditions. This could be a contributing factor explaining the structure of alliances within the maritime transport sector. Supported by the previous force, the buyers power, rivalry doesn't

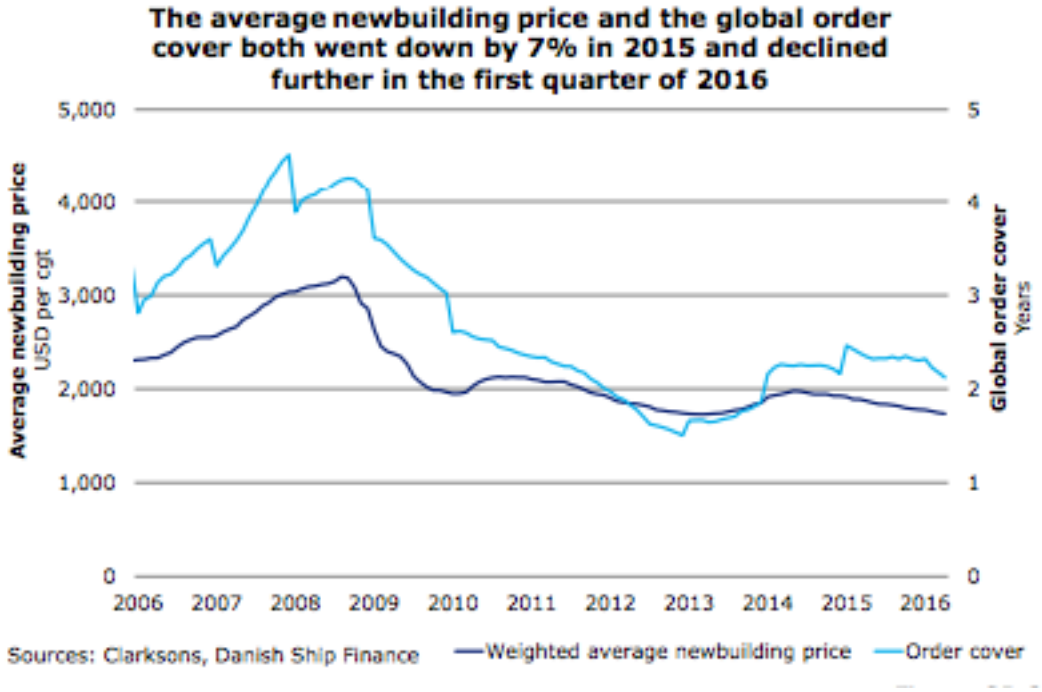
necessarily need a large number of competitors but is created through the low barriers available to customers such as low switching costs and low levels of differentiation. The level of competitors in the sector may come into question with the developments in 2017, with organisations such as Hanjin shipping of South Korea filing for bankruptcy and the competitive situation is dependent on the strength of the alliances. In conclusion, the degree of rivalry is considered high.

5.2 The sectors

Shipbuilding

Highlighted in the Shipping markets review 2016 by the Danish Ship finance, in support of the statements above, new building prices fell by 7% in 2015 alone. The diagram below reflects the change in average new building prices from 2006 pre-impact of global economic downturn on the maritime transport industry. As a result, the shipbuilding industry was heavily affected by the decline in order book in 2015 which lead to a decline in yard capacity from yard closures.

Figure 5.1: The average newbuilding prices and the global order cover.



Source: Clarksons, (Danish Ship Finance, 2016)

Falling rates have resulted in a major decline in contracting from 2015 with orders being cancelled or postponed resulting in financial complications for the shipyards. Consolidation has not old been a factor in the container sector but has cascaded to the shipbuilding market with yard unable to attract new orders. This has resulted in decline of 10% of capacity in 2015. Out of the 3 analysed reports, the Danish Ship Finance report is the only report that analyses the shipbuilding sector separately. Concluding that the market is greatly affected by the cascading effects of the markets it supports. The continual downturn will result in a reduced number of active players in the industry continually putting pressure on the shipbuilding sector.

Dry bulk

Similarly, to the other markets, the dry bulk sector has been affected by the oversupply of vessels whilst being dependent on trade by China in both iron ore and coal commodities. All three reports attribute the decline to China's desire to shift from

manufacturing to service orientation and in addition the Danish ship finance report highlights the impact of the global agenda on lowering CO2 emissions as a contributing factor to the decline in the coal trade. The three reports continually emphasis on how the market needs to strive in matching demand with supply but will struggle to do so while dependent solely on Chinese demand. The industry outlook is bleak for the dry bulk sector with all industry reports highlighting that the market is surviving on freight rate spikes.

Tanker

Unlike the other markets, the tanker market in general has rallied beyond the financial crisis. The UNCTAD and Danish Ship finance reports have performed their market analysis by further segmenting the tanker market by product carried while BIMCO performs a general tanker market review. Both the UNCTAD and Danish Ship Finance reports highlight that the crude tanker market has rallied because of the oversupply from the oil refining industries. This has been due to the lifting of sanctions which has lowered crude prices along with the excess supply to the market. The tanker sector has also manged to control its fleet growth unlike the other markets, proportionally growing with demand. While supply has been controlled from the maritime transport side, it has been forecasted that with the global climate agenda, the increase in capacity that was expected for 2017 may tip the balance.

Product tankers unlike crude tankers have acted in a different way, with fleet growth expanding faster than the rate of demand, the Danish Ship Finance report attributes this to the misalignment of vessel supply to temporary demand factors rather than end-user demand. This has resulted in the freight rates being supported by factors such as production imbalances due to seasonality and significant arbitrage trading and alternative uses to overcapacity such as floating storage which offsets the overcapacity with alternative employment of the vessels. Both reports continually highlight the

biggest risk to product tankers which can be considered for tankers in the general sense is the decarbonisation trend throughout most industries.

Lastly, the gas tanker sector, unlike its counterparts, the freight rates plunged by 80% but not due to the lack of demand but the sectors inability to manage its supply to demand. the Danish Ship finance report reveals that while demand grew by 10% the fleet expanded by 17%. In addition to excess supply, the UNCTAD report reveals that contributing factors such as the high cost of facilities for importing nations had resulted in the use of substitute means. In conclusion, a dreary outlook for the gas tanker market, with no expectation of recovery of the freight rate, the biggest impact on the second-hand vessel prices, looking to follow a similar trend as the dry bulk market.

Container Sector

In aligning with the focus of the thesis topic, the industry focused on is the container sector. While the industry analysis has reviewed the dynamics of the general maritime transport sector, as detailed in the industry dynamics explained in 5.2 the container sector has specific characteristics that differentiate it from the other sectors due to its vulnerability to variations in market environment and profitability. The following characteristics are to be discussed:

High fixed costs

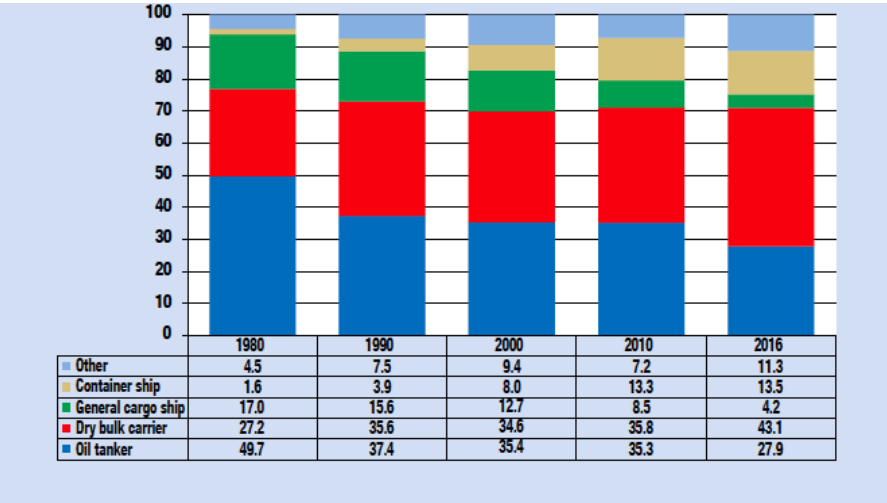
As continually highlighted, shipping is a capital-intensive industry due to the fixed cost ratio in addition, since 2007 the availability of capacity in the market has surpassed the growth of global trade cause an imbalance. Fixed cost incurred with in this sector are regardless of the amount of cargo transported by the vessel, making up a considerable amount of the expenses involved. These consist of costs such as amortization, depreciation, insurance, crewing and maintenance. Factors such as

sudden explosion of trade from developing nations as well as concepts such as globalisation contributed to shipping organisations increasing their order books for new vessels and due to the time factor of vessel construction ordered placed pre-financial crisis were only delivered during the downturn of the shipping markets. In relation to the industry analysis performed in 5.1 the high fixed costs affect factors such as the need for substitutes and increasing the level of barriers to entry.

Capacity management

At the same time as the capacity issues affecting demand and supply, shipping lines, specifically in the container segment, had also began encouraging economies of scale in hope of change in global trade and the argument that economies of scale would reduce operating costs while boosting efficiencies but failing to align their business interests with what was and is happening in the global market. **Figure 5.2** reflects the DWT growth comparison over a 36-year period for the various sectors in maritime transport, showing the substantial growth within the container sector compared to the other sectors. While **Figure 5.3** reflects the percentage growth from 2015 to 2016, noting the container sector holding the second highest growth rate compared to the other sectors.

Figure 5.2 World fleet by Principle vessel



Source: (UNCTAD, 2016)

Figure 5.3 Growth Percentage share: World fleet by Principle vessel

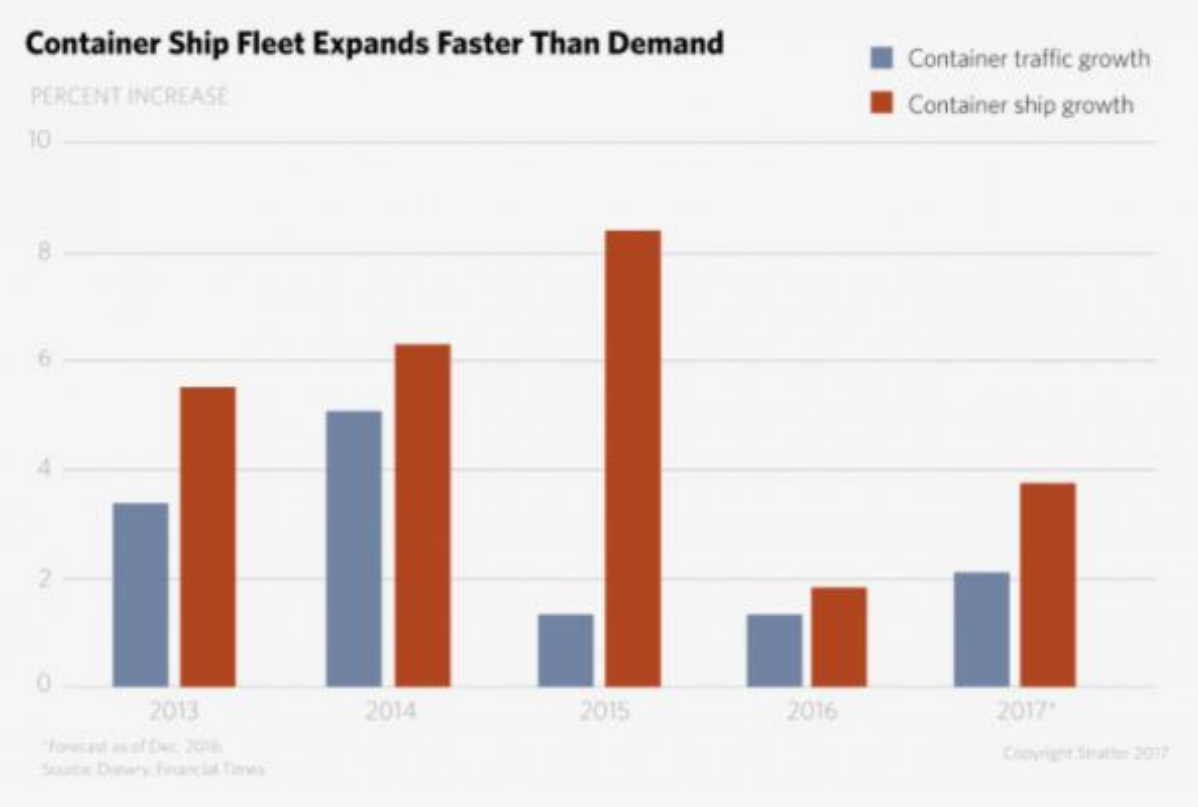
	2015	*2016*	*Percentage change, 2015–2016*
Oil tanker	488 308	503 343	
	28.0	27.9	3.08
Bulk carrier	761 776	778 890	
	43.6	43.1	2.25
General cargo ship	74 158	75 258	
	4.2	4.2	1.48
Container ship	228 224	244 274	
	13.1	13.5	7.03
Other:	193 457	204 886	
	11.1	11.3	5.91
Gas carrier	49 669	54 469	
	2.8	3.0	9.67
Chemical tanker	42 467	44 347	
	2.4	2.5	4.43
Offshore	72 606	75 836	
	4.2	4.2	4.45
Ferry and passenger ship	5 640	5 950	
	0.3	0.3	5.49
Other (not applicable)	23 075	24 284	
	1.3	1.3	5.24
World total	1 745 922	1 806 650	
	100	100	3.48

Source: (UNCTAD, 2016)

The increased size of the vessels, as seen in the **Figure 5.4** below, contributed to an already vicious cycle of unmatched business synergies, with underutilisation

decreasing the price of vessels along with the shipyard fees which increased the buying patterns of interested parties wanting to capitalise on buying cheap. In relation to the industry analysis, factors such as the supplier power, bargaining power of the customer and degree of rivalry is affected. This cycle has dragged on from 2007 to date, with out of service vessels sitting at 10% of the global fleet which has been the highest rate in the industry. Acceleration of oversupply in 2015 is credit to the 8% fleet growth while demand slowed by 1% Danish ship finance (2016).

Figure 5.4 Container ship Fleet Demand vs Supply



Source: (Danish Ship Finance, 2016)

Service offerings

Taking into consideration the conditions of the market, which have been similarly highlighted from the UNCTAD, Danish Ship Finance and BIMCO shipping market analysis, yet their forecasted market outcomes differ, while BIMCO expects the market to neither worsen or improve in 2017, the Danish Ship Finance forecasts growth on intra-regional trade benefiting liners over tonnage providers. Lastly the UNCTAD report highlights further consolidations with the focus on reducing transit times and increasing reliability but at the expense of services and port calls. In addition to transit time, the top 20 container shipping lines all offer additional services such as inland transport, 80% of which provide documentation & attending to customs formalities. 60% offer warehousing and supply chain planning and 70% assisting with vendor management. 50% provide logistics activity at the customer and supplier premises and a high 25% providing financial services (Baird, 2011)

5.3 Competition: Alliance structure

Considering the vastness of the freight transport sector, traditionally medium sized organisation were prone to pursue alliances for growth orientated strategy and attempt to detract from market uncertainties (Panayides & Wiedmer, 2011). Alone, medium sized organisations within the industry would find it hard to compete based on not having sufficient resources and the financial burden of taking part of a capital-intensive industry. Conventionally, smaller firms were more inclined to operate on niche markets and larger organisations with the internal capacity are able to manage the uncertainties such as rapid changes in demand (Panayides & Wiedmer, 2011) but with the current changes in with the market has gone through post 2008 financial crisis, larger firms have begun to part take in alliances.

The freight alliance account for approximately 77.2% of the global container capacity and it is considered that understanding how these alliances function is key to understanding global trade. As of January 2017, the market consisted of three major alliances as seen in the **Figure 5.5** below:

Figure 5.5 Alliance structure

Source: Flexport (Poskus, 2017)

Firstly, the Alliance is the result of recent industry consolidations with the three Japanese firms within the alliance expressing interests to merge between them with the desire to establish themselves collectively as the sixth largest container operator (JOC, 2017) and Hapag-Lloyd finalising its merger with United Arab Shipping Company (UASC). The alliance roughly accounts for 16% of the global container capacity covering four trade routes, namely East-West, Trans-Atlantic, Trans-Pacific and Euro-Far East trade lanes.

Secondly, the 2M alliance consists of Maersk Line and the Mediterranean Shipping Company (MSC) holding a combined 6million TEUs of which is an estimated 29.5 of the global container market share. In addition to this partnership, 2M maintains a

vessel sharing agreement with HMM, allowing them to purchase slots of 2M operated trade routes. The 2M alliance operates on East-West, Trans-Atlantic, Trans-Pacific and Euro-Far East trade lanes with limited presence in the Indian subcontinent.

Lastly, the Ocean Alliance with the aim to counter the dominance of 2M consists of the 3rd,4th, 5th and 9th largest container lines (Poskus, 2017). Representing roughly 26% of the global container trade, the ocean alliance has mostly dominated the transpacific and Asia-Europe trade lanes holding 41.4% and 34.9% of the share on these aforementioned trade lanes.

DEVELOPMENTS IN THE MARKET AND INDUSTRY STRUCTURE

Recapping the previous chapters, the importance of discussing business strategy was to understand the integration between maritime transport and maritime logistics with the goal to connect this with the activities of the next industrial changes, Industry 4.0. followed by the understanding of the dynamics of the general maritime transport sector. The choice of focusing on container shipping is because of its existing studies done between the two concepts. Characteristics of container shipping are at the same time considers challenges to integrated logistics systems which play a large role in the structure of container lines today. This chapter, benchmark maritime transport to other industries implementing digital transformation, Look at the developments in regards to the structure of container sector, through the establish strategic alliances. Discuss dynamic that comes with transformation by addressing the business model shift from linear to platform/circular economy based.

This chapter discusses developments that have affected the container sector. Within these trends also identify opportunities available to the sector. The most crucial part would be factoring in all the previous discussions to answer the central question on truly understanding the reasons for digital transformation. As shipping activities are linked with global trade, this chapter would begin with a quick overview of the changes in industrial revolution to the state in which business is conducted today. Followed by discussing the trends that have emerged from the revolutions that have developed in the container sector. Ending with the discussion on the potential shift in the business model for the sector.

Overview of the industrial revolutions

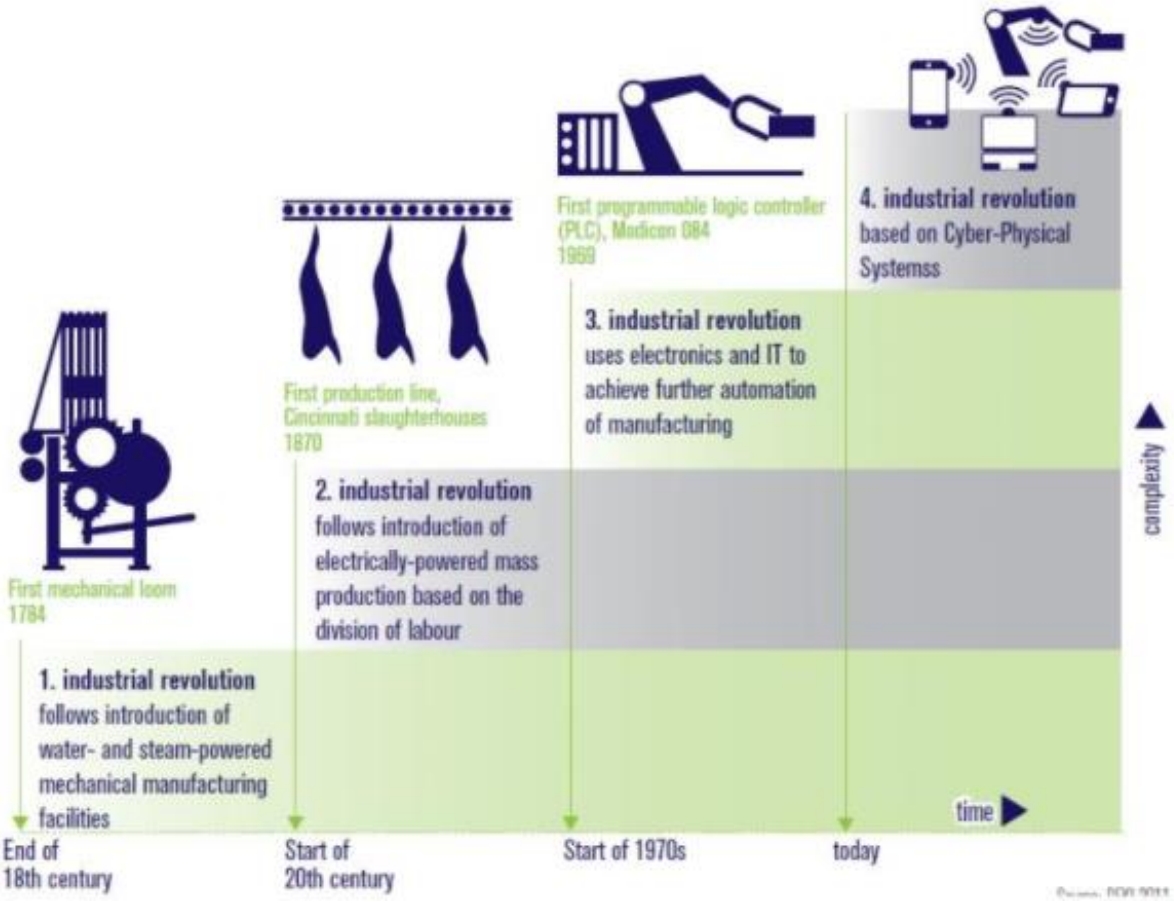
The evolution of the industrial revolutions may be linked to both economic and social growth in the identified in **Figure 6.1**. The first industrial revolution which originated in Great Britain is acknowledged as the shift from physical hand tool manufacturing to the adoption of mechanical through kinetic energy based production in which steam powered engines, developed by Thomas Newman and further improved by James Watt became the dominant power sources of this revolution. The need for this was derived from the growing necessity to increase production of both food and goods. Innovators such as Richard Trevithick developed high powered steam engines to power locomotives and in the early 1900s. during this time, Great Britain already had a solid reputation in shipbuilding and with the use of this same source of power, Great Britain's revolutionised its shipbuilding status to world leader with vessels such as the Brunel SS Great western.

The second industrial revolution was the time of technological revolutions within the industry, with the introduction of electrical-mass production and with division of labour into skilled and unskilled labour in the early 20th century and with it came along the telegraph systems and expansions of railway networks. Mass-production was supported by mechanisation which in turn increased productivity with skilled labour providing engineering based skills and unskilled labour performing simple repetitive tasks. With increased productivity and improvements in the efficiencies of the earlier mentioned steam powered engine, vessels could carry more freight than coal, resulting in the drive for international trade volumes. With mass production came electrical factories which later lead to production lines. The most notable innovation of the time is identified as Henry Ford's moving Assembly lines which can be noted as one of the drivers contributing to the third industrial revolution.

With people getting rich and international trade volumes growing because of the growing demand and supply. Goods needed to be produced faster, thus the

combination of innovations of the previous revolutions, both technological and electrical to introduce automation in manufacturing using the first programmable logic controller. This revolution brought about the use of robotic in manufacturing, also described as additive manufacturing.

Figure 6.1 Industrial revolution evolution



Source: German Research Centre for Artificial Intelligence 2015

The last pillar of Figure 6.1. introduces the concept of a fourth industrial revolution, in which connectivity is centred in the convergence of Information Technology (IT) and Operational Technology (OT). The successful merging of these concept can be summaries by the planned implementation of digital transformation.

Industry 4.0.

As described above, Industry 4.0 can be summarised by the emergence of a fourth industrial revolution. The drive behind industry 4.0 would be the change in the business model. With integration as key element, the integration of networks along with data/knowledge sharing supported by IoT has provided for business models to source added value and benefits for all parties involved through productive and efficient systems.

In linking the revolutions with the container shipping sector, as previously discussed, the main objective of the of container shipping is to provide a service in current industrial dynamic. With the aim to continuously add value to the existing activities in other words, the search for exponential growth. Achieving this requires breaking the cycle which stem for the arbitrage based strategies of buying low and selling high which have contributed to collapsing freight rates (Seaprof, 2017). Previously it was stated that one challenge in the shipping industry was treatment of symptoms rather than the underlying challenges. Referring back to the discussion on economies of scale, the attempt to correct the supply and demand imbalance with larger vessels rather than seeking ways to facilitate efficient global trade. The challenges faced by the container shipping sector are identified as:

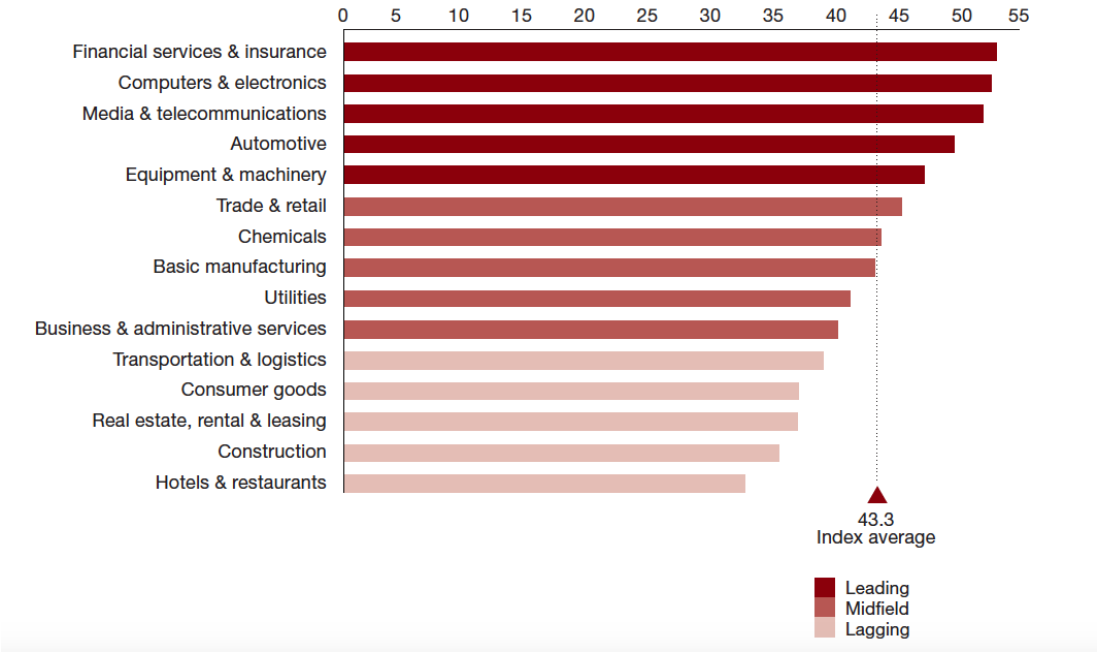
- The supply/demand imbalance has left the market saturated leaving a gap for disruptive competitive (Glave, Joerss, & Saxon, 2014) consolidation within the sector affects the smaller players and slowly pressing them out.
- The economic climate forcing organisations to price at marginal cost therefore focusing on short-term pricing strategies.
- Existing networks not aligned with supply and demand and therefore not allowing organisations to maximise profit opportunities due to lack of flexibility.
- Focus on cost saving vs profitability.

- Lack of differentiation in service offerings. Regardless of the need, the service provided is the same or similar.

The relevance of digital transformation is that change in general is a disrupter in business, yet technology and digital transformation have been labelled as disruptors (Global maritime trends 2030 2016). It can be argued that technology in itself is not a real disruptor but not being customer centric is the biggest threat to any business. In addition to the existing challenges and disruptions for the sector, the overlapping and penetration of external industries into the maritime sector has contributed to the disruption, with organisations such as Yahoo and Amazon investing in maritime activities. Connectivity has rapidly increased the bargaining power of customers and it is up to organizations and industry to understand and deal with this change. Digital transformation is happening at a global scale and understanding as well as embracing this trend could contribute to the goal of creating exponential growth which may be used to overcome the challenges stated above.

As highlighted in chapter 4, digital transformation goes beyond infrastructure and physical technologies but is about the intelligent process that could be implemented for efficiency. The industry dynamics identified in the industry analysis along with the challenges faced by the container sector have resulted in specific developments related and are reason for digital transformation. As constantly reiterated, digital transformation is happening at a global scale, **Figure 6.2** indicates the industry digitalisation index (Strategy &, 2014) the aim of the figure is to reflect maritime transports position benchmarked against other industries leading or lagging in digital transformation. The industry digitalisation index was created to gain better understanding of the relative degree to which digitalisation is transforming different industries (Friedrich, Le Merle , Grone, & Koster, 2011). Measured through four factors ranging from efforts in input, processing, output and underlying infrastructure.

Figure 6.2 Industry Digitalisation Index



Source: (Strategy &, 2014)

Maritime transport is considered a part of the transportation & logistics sector identified in **Figure 6.2** as a lagging industry in regards to digital transformation when benchmarked against other industries contributing to the global economy. Naturally it has been established that industries that are information intensive would top the index. the information intensity has driven these three industries to heavily invest in digital transformation as it has allowed these industries to maintain competitive advantage, allowed them to differentiate and specialise through continuous efficiency and because they are the industries that create the infrastructure and enabling technologies that allow for digital transformation.

The lagging industries as identified by **Figure 6.2** have been identified as labour-intensive industries, hence less focus and investment into digital platforms. While transportation and logistics is identified as a lagging sector, it is not at the bottom of

the spectrum and therefore identified as industries that are gaining momentum in comparison to the industries identified at the bottom of the index. As transportation being identified as a lagging but slowly progressing industry, the slow momentum may be linked back to (Adamson, 2017) on how shipping treats symptoms rather than the actual problems it faces. With this said, digital transformation is pushing change but the disruption truly comes from the developments from industry 4.0 and the push for shared economies in which connectivity, autonomy and the concept of access over ownership can be identified as the real disrupters and digital transformation is more of a solution to these disrupting factors.

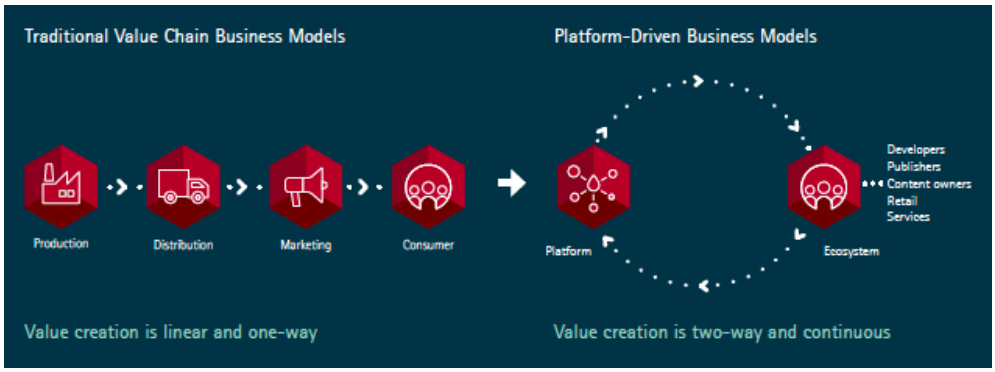
Linear vs platform

In mentioning shared economies, this concept relates to the distributive power in with IoT has contributed to the third disrupted indicated previously, the shift from access to ownership. Along with certain industries gaining momentum for digital transformation strategies, other industries have pushed the boundaries in search for exponential growth. Hence the momentum towards shared economies which are driven by all three of the disruptive factors previously mentioned, connectivity, autonomy and the concept of access over ownership.

The concept of shared economies have caused disruption in numerous industries including transport in the form of Uber, property in regards to Airbnb and Netflix disrupting the film and television industry. What all these disruptors have in common is not their direct relationship to technology, which was highlighted previously as the misconception of digital transformation is that it is about the physical technology. But the true commonality is that these disrupting organisations have been driven by having a customer-centric business model supported by digital transformation. The shift in the business model can be seen in **Figure 6.3** which reflects the existing chain for the container shipping sector and **Figure 6.4** reflects the transition from the traditional to the platform based model.

Figure 6.3 Traditional shipping model

Figure 6.4: Business model transition



Source: (Accenture , 2016)

Essentially, the global economy is supported by the manufacturing and services supply chains. Within industry 4.0 it can be understood that similarly with the shift, two concepts have been identified, namely the shared economy in which the thesis focuses on and the circular economy. As previously defined, the shared economy focuses more on the distributive power proved by the IoT which relates more to service centred businesses. The circular economy is identified as the "end goal of what used to be called closed loop recycling" (Cave, 2015) which can be identified more with manufacturing based activities.

the relevance of these topics relates back to understanding the lagging aspect of the transportation sector in relation to its strategic positioning strategy. Within

transportation, organisation either push towards a focused strategic position, concentrated on cost management and reliability, while the flexible strategic position embraces differentiation though innovation allowing them a sense of agility and gain profitability through adjusting to customer needs. Traditionally the container sector has remained safe and followed the first scenario, which is seen in the characteristics discussed in the previous chapter. Post 2008, follows of scenario one have been heavily affected as reflected by the widening gap between the demand and supply, in addition to the low earnings and margins. While container shipping has not yet been affected by the inevitable disruption competition wise, organisations who tend to fit the profile of the second scenario would in future render organisations in the first scenarios profile fit obsolete in future. Alliances such as 2M are at the forefront of embracing the more innovative and differentiation driven approve with their strides in embracing technologies. The organisations have used their adoption of digital transformation for efficiency in the form of intelligent processes and network optimisation.

Maersk has been in the lead in regards to digital transformation while operating over 600 vessel in over 130 countries, the organisation has maintained its competitive advantage through its large scale operations and networks it has established but at the same time this has also created a challenge for Maersk to sustain profitability. Essentially the key factor effecting the organisations profitability would be the slow growth of the shipping industry. In 2016, studies have revealed that the slowed growth had impacted 11 out of 12 of the largest companies, having incurred the largest losses and several under the threat of bankruptcy (Harvard Business School, 2017)

Digital culture shift

With the container shipping sector considered an oligopoly, relating to one of the characteristic being limited differentiation in regards to service offerings, the driving forces behind the push towards a digital transformation strategy have been identified as:

1. Built for change: the global business environment is becoming increasingly dynamic and organisations need to become more flexible.
2. Data driven: push from linear to shared economies pushing for intelligent and efficient processes driven by the correct data to be transferred into useable knowledge
3. Embrace change: referring back to Darwinism's' Adapt or die theory, customer centric economies require adaptability vs functionality.
4. Digital risk awareness: change in the pace in which is happening opens up gaps for risk, digital transformation comes with transparency and the importance of understanding the potential risk in relation to security factors.

LIMITATIONS AND RECOMMENDATIONS

Restrictions that limited the research were due to the lack of literature that directly tackles the focus of the research and the limitation of literation on digital transformation on the specific industry. In addition, the research has been limited by the lack of transparency throughout the industry. For future research, considerations into studies on the importance of information management would be recommendable.

Furthermore, future research in relation to knowledge management in regards to strategic decision making with in complex industries, which fall out of the scope of the research but may be considerable in the bigger picture.

Lastly, in the interest of the future impact of structural changes and digital transformation, and how disruptive developments are growing faster than the implementation strategies of applicable for further research on the legislative impacts of these changes and development may be an interesting topic for future research.

CONCLUSION

In conclusion, returning back to the main question of the thesis, what are the fundamental reasons for digital transformation in the container shipping sector? As highlighted in chapter two which establishes the research question. The objective was to answer the main question through a series of sub questions.

As a traditional industry, the maritime transport sector has endured and grown over the changes and evolutions that the global business environments have been through. In looking at the challenges derived from performing an industry analysis, it is apparent that the traditional means to correcting the trough periods in the shipping cycles are slowly becoming obsolete. The industry has thrived on economies of scale and the market dynamics of the existing business environment is changing the factors in which the sector can embrace economies of scale.

What is digitalization and how this would affect the existing business strategy of the container shipping sector?

The research has established that digitalisation going beyond physical technology, that it is more about processes and efficiencies and rather on how these technologies can be used rather than what the technologies are. The research has also identified that with changes in customer “needs and wants” have pushed the changes in industry. From a shift from operations improvement based strategies to customer centric strategies. In addition, integration is becoming more complex than what we understand. The increase in integration has contributed to the overlapping of industries which can be linked back to the lack of differentiation within the container shipping sector. With this said, in looking back at the five key components that build up the business strategy in the maritime transport sector;

1. *Scope* referring to the strategic domain or industry including market segments
2. *Goals and objectives* focused on the intended levels of accomplishments

3. *Resource deployment* denotes the management of resources aligned with achieving the underlined goals and objectives.
4. *Competitive advantage* considers the importance of competition awareness, indicating how an organisation intends to compete, either through maintaining sufficient employment of vessels or through the additional services i.e. integrated services.
5. *Synergy* referring to the compatibility of resources, an existing example may be noted through the collaboration of entities in alliances.

The business strategy components, as mentioned focus on processes and operations and the synergies between these two aspects of the business. The digitalisation strategy key components are built up of 9 factors

1. Understanding the customer
2. Top-line growth
3. Customer touch points
4. Process digitisation
5. Worker enablement
6. Performance management
7. Digitally modified businesses
8. New digital businesses
9. Digital globalisation

The shift towards a digital transformation strategy would allow for a more holistic approach. The existing business strategy, is highly reliant on integration in relation to establishing synergies between resources and processes, hence the push for economies of scale in the industry. The existing strategy has overlooked the importance of the customer aspect to business which has contributed to the imbalance in supply and demand as highlighted in the industry analysis and characteristics. As a result, this

strategy has led to less differentiation between organisations which has been identified as a challenge to the industry as well as a reason for digital transformation.

The second, the digital transformation based strategy is more pushed towards innovation, aimed not only at solving problems but allowing for differentiation through continuous improvement through allocated key concepts such as the focus on new digital businesses and performance management. This strategy can be linked to organisations that have been identified as leaders within the sector. In recapping, the discussion on leaders and laggards in relation to digital transformation, as highlighted in the chapter, developments in the industry and market structure. Leader had been identified as organisations who have embraced innovation whilst laggards are more labour intensive traditional industries who refuse to adapt.

What are the driving forces behind the digitalization of the industry?

From the industry analysis and understanding of the business cycles in shipping, it is understood that the current cycles and extending and the traditional solutions are slowly becoming less relevant for the current problems. This is due to the problems stemming from non-traditional sources in which the original strategy does not focus on, transforming the customer experience, as identified in the digital transformation strategy. With this said the driving forces for digitalisation/digital transformation in the sector are:

1. Built for change: the global business environment is becoming increasingly dynamic and organisations need to become more flexible.
2. Data driven: push from linear to shared economies pushing for intelligent and efficient processes driven by the correct data to be transferred into useable knowledge
3. Embrace change: referring back to Darwinism's' Adapt or die theory, customer centric economies require adaptability vs functionality.

4. Digital risk awareness: change in the pace in which is happening opens up gaps for risk, digital transformation comes with transparency and the importance of understanding the potential risk in relation to security factors.

What challenges face of digital transformation in the maritime industry?

Rewards do not come with risk, with the aim for exponential growth and efficient processes the implementation of a digital transformation strategy would come with challenges. The challenges identified as per chapter 6 have been identified as Resistance to change, inevitable regarding the traditional stature of the maritime industry as a whole.

Lack of clear vision for a digital customer journey as continually reiterated begins with the lack of understanding which leads to the existing and potential misconception that may arise throughout the implementation processes.

Ineffective gathering and leveraging of customer data, with such a vast industry, huge amount of data would be stored. It is imperative to ensure correct data analytical measures are put into place to guarantee efficiency and effective processes.

Inflexible technology stack and development processes, successful implementation requires a test and learn approach, in other words emphasis on continuous improvement, learning from the mistakes to improve rather than writing off disruptive developments. *"Leveraging agile processes and technologies that support frequent, if not continuous, integration and product releases are critical behaviours that lead to effective digital results."* (Tiersky, 2017)

Married to legacy business model; Relating to the challenge of resistance to change, maritime transport is considered a traditional industry. Relating to the frog in the

well philosophy, maritime transport is content with its “patch in the sky” and pushing for change would be difficult as the industry is content with the existing processes and business models.

Digital skills challenge; the technology is developing faster than the roll out of training can be provided, widening the gap for skilled seafarers in addition to changing the profile of skilled labourers in the industry.

Transparency and Security; as already experience, with digital application rapidly transforming, security of information needs to develop at the same pace. Digital transformation lowers barriers and allows for free flow but it is important manage the flow of information.

Can the existing shipping industry market survive the effects of digitalization?

Maritime transport has been identified as a laggard sector in the Industry Digitalisation Index but with momentum to fully embrace digital transformation. While implementation has been slowed in relation to the entire industry, it must be acknowledged that organisations with significant roles within the sector have undertaken great strides in implementing digital transformation strategies. Extensive understanding in what maritime transports role in sharing economies is imperative to remain a relevant industry.

Should the concept of digitalisation be considered a disruptor or a potential enabler for the maritime industry?

In summary, it is time to accept that digitalisation is here to stay and embrace the disruption it comes with to prepare for future disruptions. Digital transformation goes beyond technology and improving processes. It is about change management, " a company's ability to evolve its corporate culture to not only take advantage of emerging technology but to also critically embrace the new business strategies that those technologies drive." (Accenture , 2016).

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