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WORLD MARITIME UNIVERSITY

Malmö, Sweden

THE TITLE OF THE DISSERTATION

**Measurement of Digital Maturity in Liner Shipping
Companies' Business Models**

By

LUKAS MAGANJO

KENYA

A dissertation submitted to the World Maritime University in partial
fulfilment of the requirements for the award of the degree of

MASTER OF SCIENCE

in

MARITIME AFFAIRS

(SHIPPING MANAGEMENT AND LOGISTICS)

Year of graduation

2022

Declaration

I certify that all the material in this dissertation that is not my own work has been identified, and that no 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.

(Signature):

(Date):

Supervised by:

Supervisor's affiliation.....

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First and foremost, I wish to thank the Almighty high for blessing me with the gift of life, good health and ability to pen down my contribution to the maritime industry. This could not have been possible were it not for his will and grace on me. Second many thanks to my guardian, my parents and siblings for their endless support and believe in me. I appreciate their nourishing words of encouragement and ever reminding me that the world made me and now it is my time to make the world better.

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“BLESSINGS TO ALL OF YOU”

Abstract

Title of dissertation: **Measurement of digital maturity in liner shipping companies' business models**

Degree: **Master of Science (MSc)**

The business environment of today is fast changing and been revolutionized by the digital era. Technology is advancing faster and taking less time to be widely adopted than ever before. The volume of data available in the world is growing exponentially and is expected to be ten times more in 2025 than it was in 2017 (International Data Corporation, 2020). As a result, digital business models have been mushrooming and reshaping businesses and industries as a whole. The data is being exploited as a tool to reengineer the business process and creating significant efficiencies for the business and their client base. Accompanying this has been scholarly articles that seek to unravel the influence of digitalization on business models. However, studies on how digital matured these business models are and how it could be effectively measured remains limited. This study therefore aims at filling this gap, by providing a comprehensive overview on the concept of digital matured business models and developing a framework that can be used to measure digital maturity of business models, with specificity to the liner shipping companies. The study employs the methodology of systematic literature review and provides relevant statistics from the findings. Based on the findings it adopts the VISOR measurement framework to measure the digital maturity of liner shipping business models. The VISOR framework is characterized by five elements – Value proportion, Interface, Service platform, Organization model and Revenue model. Each of the elements is accompanied by a series of questions which are used to measure the digital maturity of liner shipping business models. The developed framework is tested and validated on the top 20 leading shipping companies as per the Alphaliner report (2022). This model is of vital importance and can be applied by interested liner shipping companies that seek to access the extent of digital maturity of their business models.

KEYWORDS: *Digital business models, Maturity of digital business models, Measurement of digital models, shipping business models*

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List of Abbreviations

UNCTAD	United Nations Conference on Trade and Development
DCSA	Digital Container Shipping Association
IoT	Internet of Things
CPS	Cyber Physical Systems
BMs	Business Models
LSC	Liner Shipping Companies
DMBMs	Digital Matured Business Models
MSC	Mediterranean Shipping Company
CMA CGM	Compagnie Maritime d'Affrètement and Compagnie Générale Maritime
COSCO	China Ocean Shipping Company
SRL	Systematic Literature Review
CIMO	Context, Intervention, Mechanism and Outcome
DMM	Digital Matured Model
RFID	Radio Frequency Identification Systems
OPEX	Operational Expenditure
NYK	Nippon Yusen Kabushiki company
TAM	Technology Acceptance Model
KPIs	Key Performance Indicators
IBM	International Business Machines
VISOR	Value proportion, Interface, Service platform, Organization model, Revenue model
EU	European Union
SMEs	Small and medium-sized enterprises
EBITDA	Earnings before Interest, Taxes, Depreciation and Amortization
ROE	Return on Equity
ROI	Return on Investment
ROE	Return on Asset

CHAPTER ONE: INTRODUCTION

1.1 Background

In the recent years, the world economy has been characterized by a lot of uncertainty and volatility. It affects the liner shipping industry which is a derived demand (Ma, 2020). The industry is currently facing challenges of climate change, political aggression and ongoing effects of the pandemic. Such has resulted in market instability and raising trade protectionism which has induced a limited growth rate of 0.5% as of 2019 and a fall in international trade by 4.1% in the year 2020 – the pandemic year (UNCTAD, 2020). Hope was built on the year 2021, with a 4.8% growth been projected (UNCTAD, 2020) but just before this had been realized at the dawn of 2022, Russia invaded Ukraine and once again maritime business was subjected to jeopardy.

The accumulation of such disruptions has ignited two major debates, which are projected to revolutionize the whole shipping sector. The first is de-globalization – an era foreseen to be characterized by shorter supply chains and increased regionalization, which for instance induced the intra- Asian trade. According to UNCTAD (2020) the region accounts for 41% and 61% of loaded and unloaded goods respectively of world trade. Second is the digitalization era, where technology has been playing a major role in improving the efficiency of organizations and inducing massive changes in the way of doing business (Oshadhi et al., 2019).

According to Hellweg (2021), digitalization has become indispensable. It brings an array of business opportunities and at the same time, comes with new set of challenges such as: increased competition and increased customer expectation. The pressure has been for organization to meet these challenges by align their business models (BMs) for survival. As a result, the concepts of: internet of a lot of things (IoT), Big Data, Blockchain and Cyber-Physical Systems (CPS) have become omnipresent.

The shipping industry for decades has been known to be a conservative industry but not any longer. It has turned out to be a race against time where, the sector is developing digital BMs. In particular, has been the liner shipping sector as its said to be in its maturity stage (BCG, 2018). It aims to withhold the “new landscape of competition” presented by more agile companies such as Amazon and Alibaba, to proactively deal with its stakeholders and customers and to align their traditional BMs into the digitalization era (Song et al.,2018).

Exemplifying this has been the formation of Digital Container Shipping Association (DCSA) in 2019. The association advocates for better customization which will enable liner shipping companies (LSC) to remain competitive and calls for a common technological foundation that will enable global collaboration, and promotion of efficiency and agility.

The Covid -19 pandemic, expedited the need for LSC to embed digitalization into their BMs. Notteboom et al. (2021), defines Covid -19 as a 'catalyst' for the shipping industry. It has created a need to upgrade its digital aspect, which has resulted in an increased push for policy and investment in digitalization from the governments, maritime stakeholders, and the customers (Iven,2020; Kuo et al, 2021; Lloyd's list, 2018).

True to say, the shipping of today has become more dynamic and unpredictable. Ships are being taken to scrap at very young ages for example, the India Rickmers container panamax scrapped at 7 years old. LSC are much vulnerable to the world trade volatility as explained by the increasing trend of strategic alliances (Carriou et al.,2021). Supporting this notion is Y.K. Pao – late Korean shipping tycoon world international shipping holding LTD, who stated that:

“In truth the liner shipping business is not an easy one. It's more like a poker game where you have to keep putting more of your money that you are about to lose. From the investors point of view, they have to keep investing in service upgrades and expansion only to find low returns from investment as well as the low freight rates. The only promising way out is to put your house in order and differentiate your services”

LSC must then transform comprehensively in addressing their mode of doing business. It remains to be the only way in which they can step ahead of competition, maximize if not maintaining an eternal profit margin and avoid been squeezed out of business. Nevertheless, the LSC digital transformation remains to be challenging. LSC need to know: why, where and when to progress towards the digital transformation. This induces the need for Digital Matured Business models (DMBMs) assessment. The models are meant to define action plans that will guide LSC in achieving their desired digital maturity levels, act as reference points which organization can comparable themselves to other organizations in same economic grouping or the digital maturity levels of other sectors.

The high interest in digital transformation has resulted in a pool of digital maturity model by various scholars and certainly, making it complex for organizations to decide on the unique model to adopt. However, this has not been done for the liner shipping companies

for which to the best of our knowledge no DMBMs have been developed. In this study we therefore provide an analysis of the concept of DMBMs, consolidate them through a systematic literature review and based on the findings we develop and propose a measurement model whose applicability is tested on the top 20 leading liner shipping companies.

The core question in this study is therefore: “how to measure the digital maturity of liner shipping company business models.”

The rest of the paper is organized as follows. Sub-section that follows presents the research objectives and questions employed in this study. In chapter 2, based on Systematic Literature Review (SRL), we discuss the trends in liner shipping and navigate through the concepts of digitalization, business models and critically analysis the existing digital maturity BMs in literature. In chapter 3, we outline our methodology, present our measurement model, its key variables and questions associated. In chapter 4 we present the results on statistics and contextual analysis. Chapter five discusses the main findings while chapter 6 presents the conclusions, key recommendations and possibility for future developments.

1.2 Research Objectives and Questions

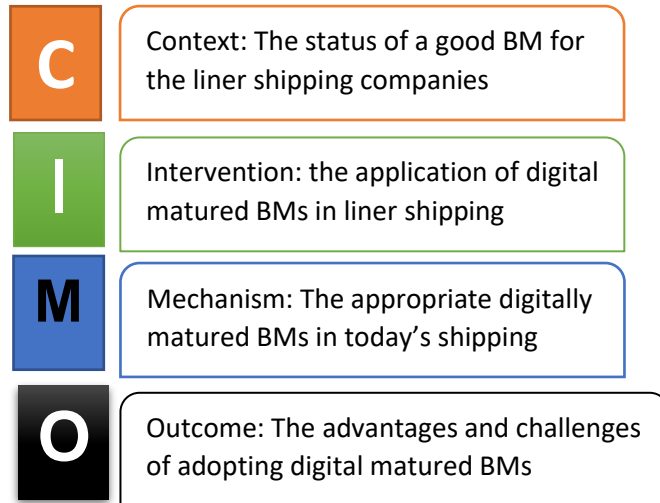
To be considered first are Ma (2020) principles of successful maritime transformation that states:

- i. It is not about choosing the right technology, it's about solving the key problems be it economic factors, technical factors or operational factors.
- ii. It is not about cost saving it's about value creation; getting our customers' needs right and providing a value for their money.
- iii. It is not about improving operations it's about building new business models that orchestrates with the given business environment.
- iv. It not about getting cargo it's about getting data and using it to make informed decisions for not just efficiency but also standing out amongst your competitors.
- v. It is not about the new technology it's about new leadership, organization and the people.

From the highlighted principles, four research questions are developed and are based on four pillars meant to support and guide towards achievement of this study objective.

To do so we consider the CIMO – Context, Intervention, Mechanism and Outcome approach (Costa et al., 2018) as shown in figure 1.

Figure 1: The CIMO approach



The research questions are as follows:

- RQ1: What is the status and characteristics of a good business model for the LSC in literature?
- RQ2; Which models are being applied by LSC in measuring their digital business model maturity?
- RQ3: Which model is the appropriate in measuring the digital business model maturity in the 21st century liner shipping?
- RQ4: What are the significances and deficiencies associated with the adoption of digital matured business models?

CHAPTER TWO: BUSINESS MODELS AND DIGITALISATION IN LINER SHIPPING

2.1 Literature Review

This section presents a review on digital maturity of business models (DMBMs) with focus on the most recent and relevant studies. We offer a brief presentation on the recent trends in the liner shipping market, followed by a discussion on: digitalization, business models, maturity and how the three elements interrelated. Lastly we provide a presentation of relevant digital maturity models applicable to the liner shipping context.

2.1.1 The Trends in Liner Shipping at a Glance

Maritime transport is a key driver of the global economy and is at the Centre of the world trade operations (Mohammed et al., 2018). Liner shipping is oriented towards provision of commercial services which are offered to shippers, on fixed routes, according to timetables at specified port connected through containership. (Ma, 2020; Cariou et al., 2022). These services require setting up of an extensive infrastructure and designing of liner service network, which are a complex task (Haralambides, 2007; Hellsten, 2020).

In the shipping business environment of today, only the efficient, digital and reliable shipping companies stand a chance of long-term survival, profit acquisition and maintenance of healthy economic growth. The liner market has been on radical shakes up and focus has been to abate the curse of red ink on the operation bottom line (Seok-min lim, 2011).

The liner market has been characterized by many fortune making and loss of others. The market dynamic has become more complex and risky. This can be accustomed to: inconsistent freight rates, poor financial results, unregulated shipping environment, and new technology that have profoundly changed the competition game. The industry has constantly been subjected to uncertainty pressures like never before. Demand has been falling, trade volatility has increased, Innovative business models and digital technologies are disrupting the incumbents and industry as a whole and the call for climate change is heightening the cost pressures and the competitive forces.

According to BCG (2018), a bigger threats lies in the horizon. This is coming from the digital attackers who are the traditional logistics players and new entrants who have adopted digital technology in providing seamless end to end services. In the case that their business models are successful, LSC are at risk of losing their most profitable customers.

Nonetheless, a fortune still lies for LSC which are risk-appetite. All they ought to do is to optimize mitigation of these risks through adoption of expenses reduction strategies, explore new revenue streams and reshape their business models so as to survive and meet the social demand (Seok-min lim, 2011; Lorange et al. 2012). Accordingly, this has to be done in consideration to the resilience and flexibility demanded by the competition present in the market (Feibert et al., 2018).

A time has now come when the box industry has no choice but to join the digital revolution, strengthen its relation with the end customer, improve its efficiency by going beyond its traditional ways of operations, and use scenario- based modelling in unlocking its growth opportunities (BCG, 2018).

Presently, liners are paying more attention to their internal organization and restructuring of their business models. There is a considerable increase in the market for shipping financial derivatives and entry of new talent (Lorange et al., 2012). Such a trend mirrors a high fragmenting value chain. Interesting to note is the attracted attention and interest among industrial practitioners and scholars who seek to find out ways of optimizing the efficiency of the value chain. Digital aspects such as e- platforms, internet of a lot of things, advanced analytics, block chain, autonomous vessels and robotics and cyber security have been seen as a promising path, and have now become core factors of consideration in business modelling. The focus has been to create innovative digital business models that are based on a well-orchestrated and market oriented intelligence that responds to the shifting competition base and assimilates the trend in the digital market.

The demand for maritime transport has decreased since the end of the financial crisis, but this has not stopped liner companies from ordering new tonnage. The question that arises is why LSC would still focus on increasing their market share and abandoned profitability (BCG, 2015). As a “natural” way of balance, Some LSC have gone out of business for example, Hanjin and others have managed to stay (Song et al., 2019). Their stay back could be explained by their wise choice of opportunities. According to Mulder and Dekker (2017) the choices could be associated with the three operation modelling technics that include: strategic planning, tactic planning, and operational planning.

- The strategic planning - has two aspects: fleet size and mix problem, market and trade selection. The former involves fleet composition and the trade routes to

serve. Aim here is to establish the perfect balance in the benefit of economies of scale and vessel optimization.

- Tactic planning – involves network designing, pricing and repositioning of empty containers.
 - Pricing, two approaches have been eminent: the market pay and cost-plus. It's the desire of every liner company to maximize its profit and register a return on capital cost (BCG, 2015). Profits can be achieved through: internal transformation and unlocking the full synergy ability through alliance.
 - Empty container repositioning – involves the reduction of the imbalance associated with high cost since there exist no clear revenue. Some recent scholarly articles have put their thought in solving this menace. Kuzmicz and Pesch (2019); Kim and Glock (2014), Suggests the adoption of foldable containers and application of the Radio Frequency Identification systems (RFID) which could enhance empty container management, their traceability, predictability flow, information processing when handling containers and inducing customer to return containers.
- Operational planning - involves determining of cargo routing in the networks, handling of disruption and whenever necessary readjustment of pricing.

2.1.2 Digitalization

The ever changing market conditions plugged with numerous uncertainties have necessitated a need for a more aggressive digital transformation. “Organization are required to adapt to it, whether they like it or not.” (Bengtsson, 2017). But what exactly is digitalization? Quitzau et al. (2018), defines digitalization as a transformation - a take over from the industrial age and a disruptor of established structure and business models. Gartner Inc. defines digitalization “as a process of transforming a business model so as to provide new revenue and added values through the application of digital technologies. That is to say, a process of moving business into digital” It is the way business processes, operations and data processing are automated (Tijan et al., 2021). Brennen and Kreiss, (2016) defines digitalization as the restructuring of the life domains by use of computers and technologies. Bloomberg (2018) makes a distinction between digitalization and digitization mentioned it as a transformation of process and information respectively.

Example of such application is the block chain technology, that improves efficiency of ship recording, provision of real-time cargo status and promotion of data sharing among shareholders resulting to advancement of transparency. In addition, we have internet of things (IoT) and sensors that captures container number and vehicle at port of terminal gate feed this data to the cloud environment and this data can be analysis and used to pre plan needed operation. Same concept has been applied at port of Bremen Germany where there have Truck identification system at their gate way and using this data are able to plan an optimal container pick up which has drastically reduced their port congestion.

In regards to LSC way of doing business, digital aspects that have been implemented so far include: document management, empty container repositioning, pricing, network design and container tracking. For example, Maersk have the customer valuation strategy where they reduce the physical distance between the customer and his/her goodies. They make the customer feel as if he/she has the controls over the entire supply chain through tracking and provision of seamless data. In addition, they have embedded data into their operation planning. from this they can plan demand, sense demand and design networks much efficiently than their competitors.

Of vital importance is to keep pace with the fast changing digital era especially from a business perspective. Digitalization thus “a process that triggers reaction that lead to adoption of strategies for the purpose of keeping up with developments, changes and barrier management” (Vial, 2019). This paper therefore considers digitalization as: “*the use of digital technologies to transform the business process*”

2.1.3 Digitalization in liner shipping

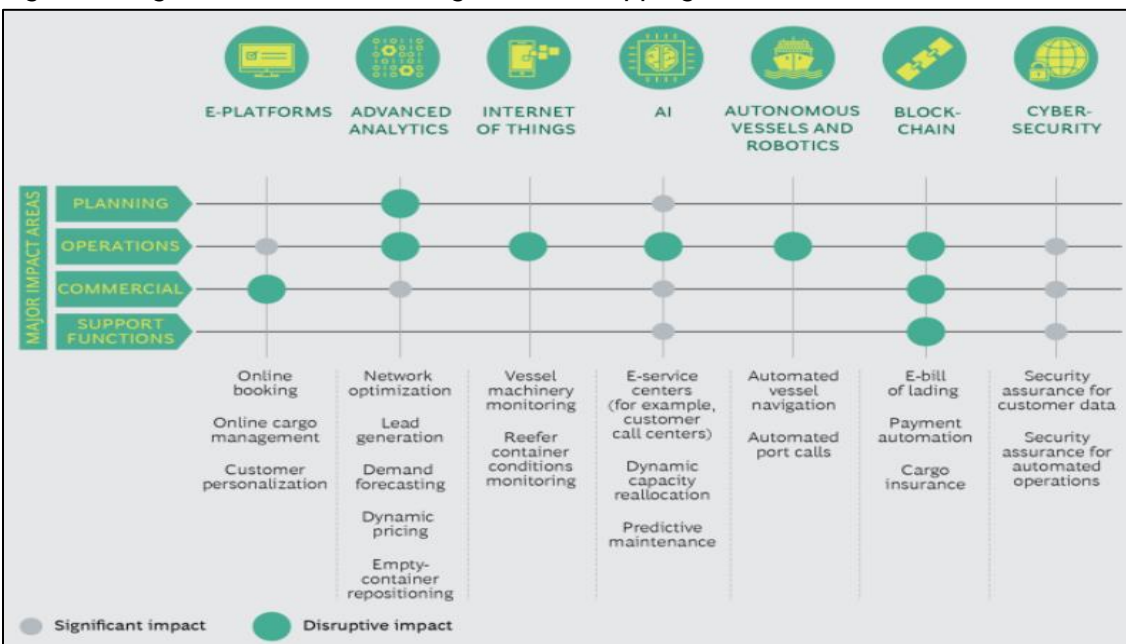
It's no longer an option for the liner industry to digitalize. The market is demanding that they must. Digitalization opens the doors of business and customer valuation. The Covid -19 pandemic catalyzed this where only the resilient and digital enabled liner firms were able to effectively weather the presented storm. Through digitalization LSC can: improve their performance and efficiently integrate with their supplies, strengthen their direct relationship with end consumer, enjoy cost reduction and development of new avenues of making revenue (Bengtsson 2017; BCG 2018).

Digitalization offers a chance for LSC to foster their business growth, improve their operations, enhance efficiency and effectiveness of data security and an improvement of internal controls. Achievement of these benefits can be optimized by adoption of the seven

valuable trends of digital transformation highlighted by Maydanova et al. (2020); BCG, (2018) as shown in figure 2.

Participation of a LSC in these trends is foreseen as an opportunity to gain a competitive edge which according to Balci (2021), involves the resources and not product. The resources include: the financial asset, know-how, procedure, business relation and the processes. Nonetheless, it should be noted that this requires consistent actions right from the strategic formulation to implementation. To obtain successful future development, new architecture solutions have to be adopted and should factor: IT architecture and strategic business alignment (Maydanova et al., 2020)

Figure 2: Digital trends transforming the liner shipping



Note: From BCG report, (2018)

<https://www.bcg.com/publications/2018/digital-imperative-container-shipping>.

Poulis et al. (2020) in his study on vessel automation mentioned that a company that adopts digital transformation creates value – a key factor of consideration of the modern customer. The same sentiments are echoed by Maydanova et al (2020). They identified 5 strategic digital transformations domains that will enable a company to develop effectively in context of global change, reduce its negative impacts and take advantage of the arising change. These strategies include:

- Customer connection
- Data processing and analysis

- Customer valuation
- Competition
- Innovation process

Lambrau et al. (2020) provides a qualitative study on application of internet of a lot of things, artificial intelligence and block chain and found out that the key motivations were based on: customer and business expectation, need to gain market share, foster process improvement, enhancing cost efficiency and creation of data monetized model – the company is able to obtain return on revenue that matches the quality of valuation it is selling.

Application of block chain technologies into business modelling in the liner shipping market, has enabled digitalization of custom clearance, documentation and bills of lading. This echoes Tang (2019) findings in his study of application of block chain in the Taiwanese maritime stakeholders. He concluded that Block chain motivates: ease of paperwork, enables standardization and promoted platform development. However, the major barriers to adoption of block chain technology have been the regulatory bodies and the public authorities (Barassano et al., 2020).

To have a deeper understanding of the connection between digitalization and business models we borrow the success factors highlighted from other industries. Looking at the manufacturing companies, Rohmer (2016) states that business model act as a mediator between strategic level and the operational level and that a great and valuable model, must be accompanied by mediocre maturity of technology. Through digitalization, a change looms in the future B2B relations is projected. Currently B2C have radically changed and are the beckon for success. The digitalization of the manufacturing industry comes mainly under three dimensions that is: organization, environment and the technology.

Harchekar (2018), studied digitalization in the bank sector, the India bank as a case study and benefits identified from this was the ability of bank to provide an enriched service to its customers. This resulted in customer convenience and time saving. He noted that digitalization decreased the human errors and in effect builds on customer reliability. In order to build loyalty and customer satisfaction, a trending factor he identified was the placement of power in the hand of the customer through programmes such as open banking and payment services directive.

In regards to the aviation industry its noted that similar approaches as the shipping industry have been considered. This entails the application of the seven digital trends (see figure 2) in enhancing customer relation, improving on performance, cost reduction and gaining of a competitive edge (Kuisma, 2018).

2.1.4 Liner Shipping Business Models

Before analyzing the liner shipping model it's essential to have a thorough understanding of what a business model is. Schamallo (2013) defines business model as a basic logic explanation, of the benefits obtained by your customers and partners. It responds to the question on how the given benefits flow back into the company in terms of revenue. The created value differentiate organization from competitors, strengthen its customer relationship and enables realization of a competitive advantage. There are five facets in a business model:

- Customer facet - involves customer relationship, customer segmentation and customer channel.
- Benefit facet - involves the values services and product.
- Value addition - entails the skills, process and resources.
- Partner facet - entails the partner, partner channel and partner relationship.
- Financial facet - involves the expenses and revenues.

The aim is to combine all the facets, in a way that they mutually reinforce each other making it possible to attain growth and limit possibility of imitation by the competitors.

According to Lam and wong (2018) a business model is “a unit of analysis focused on firm's activities in way of doing its business, which interlinks with its partners to explain the process of value creation and capture.” Magretta (2002) succinctly defines business models as been a company's narrative of responding to question of identifying and creating customer values and making profit through delivery of their values at suitable costs. Fjeldstad et al. (2010) defines business model as a way in which firm creates and capture value. Often the key is to capitalize on new technology or respond to shifting competition base (Johnson, 2008).

The first early striking business model attempt was the American swift, developed by Gautas Swift. The years before 1870, cattle used to be shipped live from the Midwestern ranches such as: Omaha and Chicago, to the east coast where the cattle were slaughtered and sold to the local butchers. Gaustas foresaw that economies of production, transportation and centralization could be achieved if the cattle were shipped already

slaughtered and refrigerated. The model quickly displaced existing business models such as: network of shippers' model, and the east coast butchers model. Upon customer acceptance of his refrigerated meat, which was as fresh as that slaughtered locally, its availability at a cheaper price, boomed his products and was able to develop a niche in the market (Teece, 2010).

Teece (2010) talks of containerization as a revolutionary business model that transfigured the maritime transport. Years before 1960, cargo transportation for liner shipping, was in barrel and crates. It was extremely cumbersome to load and unload cargo and time consuming as ships could spend weeks if not months at the port. This discouraged international trading and if it happened it was accustomed to very high costs. Development of standardized steel boxes by McLean meant, Cargo could now be transported more safely, easily handled and triggered cargo data availability.

Overtime, bigger vessels have been developed in a way to: promote economies of scale, improve system reliability, and facilitated mushrooming of complex hub and spoke network. Fine tuning and optimization of these operation has translated to deeper pockets not just for the customers but also for the liner shipping companies (Haralambides, 2007).

Lorange and Fjeldstad (2012) did study shipping business model whose approach was on two models: the value network and the value shop.

- The value network involves the creation of value by a firm that is engaged in global cargo flow, financial instruments and information. Key aspect is to mobilize knowledge resources and innovatively solve client problem. As for the network business (ship brokers, logistics services) it's about building connectivity and conductivity of network by defining nodes and identifying products to be exchange. It has three categories of activity:
 - Network promotion and contract management – attracting customers, selecting and retaining potential clients
 - Service provisioning – involves management of inter-customer flow of information and goods and the financial instruments.
 - Infrastructure management – maintenance of the financial, physical and information infrastructure that enable firm provide services to their clients' base

- The value shop model – involves a case by case creation of solution through resource mobilization, the people, tool and relationships. Example of this is the shipping consultancy. His conclusion was that a business model is an abstract of a business and must be characterized by two jargons. One is the activity configuration which represents the organization technology of the business and the other is resources which organizations are needed to invest and exploit

As of today, most of companies' business models are geared towards provision of e-commerce, data optimization, corporate use of IT and strategic value creation, innovation and technology management. Examples of these are the e- book business model, archetypes business models that coordinate social and technological innovations, business models that focus on application of internet of a lot of things and information systems. (Al-Debei & Avison 2010; Boken et al., 2014; Chang et al; 2015; Dijkman et al., 2015).

Yang (2019) studied on block chain modelling which focuses on, digitalizing the shipping sector. Specificity to the supply chain sector, which is the lifeblood of liner shipping. The aim is to “improve efficiency in shipping records, keep real – time status of cargo, reduction of cost, risks and custom clearance time.” Lieber (2017) acknowledges this concept and adds that block chain technology, simplifies the decision making process, facilitates data sharing which improves transparency and trust among trades partners and optimizes real-time. Maersk is an example of a companies that has adopted block chain technology, where through it, it's possible to tracks position of their containers, temperature and other need to know conditions.

Lam and wong (2018) developed three major liner shipping business models. They include:

- Cost leadership model – for any company cost control is an essential element. Given the changing and challenging dynamic of the shipping industry most liner companies are finding self at crossroad. The way out has been deployment of cost minimization strategies. By nature, liner shipping companies do experience high fixed cost due to their fixed schedules as a result there lies a need to optimize operational cost so as to achieve the possible least break even. This can be achieved through improvement in operation productivity and capacity utilization. Aim of this is to low the bar for the OPEX in ways such as slow stemming, disposal

of old vessel and investing in new when prices are low, trade lens rationalism, alliance formation for enjoyment of scales of economies and increasing of the network service coverage. By this the companies are able to offer very customer based and competitive prices.

- Service differentiation and innovation model – This model assumes that the liner companies are already performing the common cost reduction mechanism. The focus is thus shifted at services differentiation, the value and innovation. The focal point in this model is been a customer – centric company so as to obtain a greater competitive advantage achieve price control upon realization of a niche in the market. However, limitation to this model is its associated high risk due to high investment required and the uncertainty of returns. Example of such a model adoption is the Daily Maersk by the Maersk liner.
- Hybrid model – It considered that in this model the liner companies are equally investing in resources as well as almost equal in cost minimization and service differentiation. What therefore needed is for the company to be versatile according to the given market condition. Here two jargon exist and to achieve a breakpoint in the market, a right balance has to be between the two jargons. The balance results in an approach where competitors have it rough in replicating the approach and thus companies that develops it has an extended enjoyment of a competitive advantage. Example of this is the Nippon Yusen Kabushiki (NYK) company.

The “value” has been the most upheld element in creation of a liner operation model. Customer satisfaction determines the breakthrough of any business and a good platform to rely on when making informed business decisions. Venkatesh and Davis (2000), park et al. (2014) talks of the Technology Acceptance Model (TAM) that is used in determining the customers’ wiliness in accepting new technologies with regard to their usefulness and ease of use. Balci (2021) in his study concluded that “digitalized services and operation of container lines have an overall influence on customer loyalties”

BCG (2018) focus on cost reductions BMs for the liners. They fronted a triptych transformation approach that “creates value beyond the common deployed change levels and exploring next frontier levels.” It entails:

- a) Funding the journey

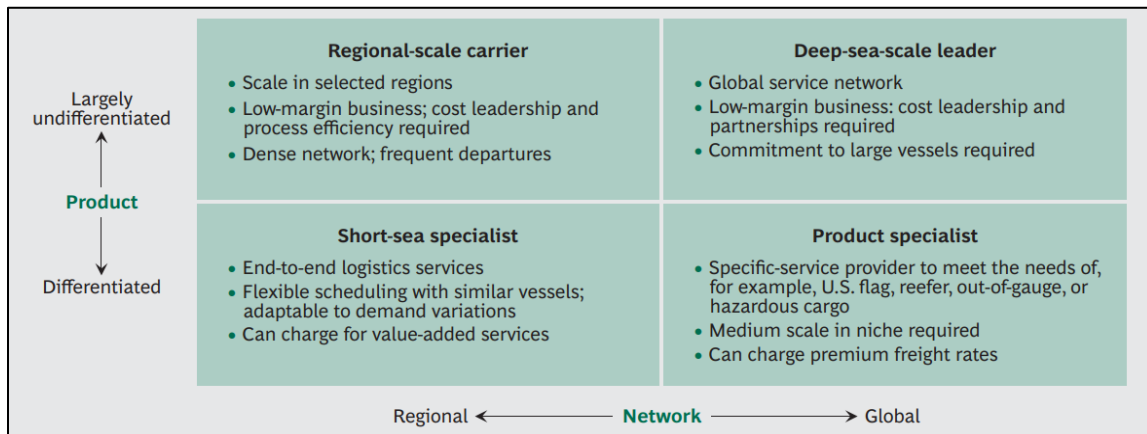
Entails achieving immediate wins and generating quantifiable bottom-line impacts. Liner needs to initiated cost efficiency measure that will generate funds for their transformation

journey. Common practices have been speed equalization, steaming execution, reduction of ship dwell time, advancement of procurement strategies, offshoring of activities to low cost countries such as documentation, and accounting. The criteria here is to have a: strategic focus, pricing for profitability, network design excellence, procurement excellence and project execution.

b) Winning the medium term

Upon a successfully securing the short term wins, liners must apply the resultant momentum and developing a competitive advantage. At this stage liners rethink of their business models and what right operating model to use. Four business models have been discussed as shown in figure 3.

Figure 3: Liner shipping business model



Note: from BSC analysis 2018.

<https://www.bcg.com/publications/2018/digital-imperative-container-shipping>.

- i. Regional-scale-carriers – The liners here focus on creating a niche at the regional level. They develop a closer regional relationship and taking of the regional knowledge have a chance to compete with the larger carriers in market
- ii. Deep-sea leader – operate on a global scale, trade is of high volume and leverage their services by use of large vessels, network reach and density.
- iii. Short-sea specialist – offer services in short hauls using smaller vessels at regular services and go further into offering additional logistics services. depend them lacking scale they offer differentiated service which through it are able to compete with global carriers.
- iv. Product specialist – they capture a specific niche in the market. For example, reefers, or a specific requirement of a given flag state e.g. U.S. for this there have the advantage of charging a premium price.

To note however is that upon success in establishing a model, liners should then establish the right operating model which depicts how it will deliver its services and value to its customers. With a win in the medium term, the liner can pursue next frontier which evolves leveraging of cost and revenue so as to achieve a competitive advantage. Some cost frontier approach could involve: equipment and repositioning efficiency, advanced shared services and lean operations. As for revenue strategies could be big data opportunities and sale force effectiveness.

c) Establishing the right organization, team and culture.

This entails establishing a flatter and agile organization with simplified reporting layers, well-articulated span of control, having the right skilled and talented team and establishing a culture performance by use of right KPIs and targets,

The discussion in the above literature seems to suggest that most of the Liner shipping BMs are focused on three major aspects. That is: how can LSC effectively make money, satisfy the needs of their customer and how their can streamline their delivery process. In order to increase their chances of survival, digital technologies need to be embedded into the three major aspects. This aligns with Lind et al. (2021), where they propose that with digitalization LSC can improve their shipping operations, maximize returns and make informed shipping decisions. However, it is paramount importance that LSC are aware of the status of their Business Model Maturity.

2.1.5 Business Maturity

In the present, ambitious and rapidly changing business environment, a matured business model is one that is responsive, agile and able to differentiate itself from its competitors (Rübel, 2018). "Maturity is the attainment of a specific ability or reach of targeted success from an initial to anticipated level." In so doing an entity has the ability to illustrate its preparedness in defeating impending changes (Kutnjak et al., 2020). Nikkhou et.al.(2016) referred maturity as being a state of perfect condition, that evidences an achievement and provides direction or guidance on how to preventive or correct problems.

Business maturity is a non-ending process of constant transformation to the fast changing business environment. The aim is to arrive at a palatable level of maturity that withstands the conditions and difficulties presented by the business environment. Critical factor to its progression is measurement. The current trend in business model maturity is a transformation that factors in digital aspect and market intelligence. It mainly requires an investment in information and telecommunication, an adjustment of the business systems,

culture, employees, customer valuation and monetization of their services. However, Key challenges identified by Erol et al. (2016) in his International Business Machines (IBM) study, with regards to business adopting digitalization was: inadequate know-how and high investment cost and failure to consider the capabilities of the digitalization aspect. The last factor is of vital importance to this paper as it focuses on how the LSC can ascertain their capabilities by referencing onto DMBMs.

2.1.6 Digital Matured Business Models (DMBMs)

These are tools used by organizations as navigational aids in achieving their desired objectives or developments. They are tasked to define maturity levels so that organizations can access extent to which they fulfill their defined requirements. They are not meant to provide clear cut strategies, but frame of reference and responsiveness. Through them, organizations can utilize the assessment results to make audits, benchmarks, track progress, and evaluate organizations elements such as: strength, opportunities and weakness and sequencing the levels of maturity. Berghaus (2016) and Nerima (2021), in their studies highlighted that these apparatus, are used in two ways, prescriptive and descriptive. In descriptive it entails the measurements which should be taken (plans) while prescriptive focus on the actualization of the planned or capacities of organization so as to achieve the desired development levels. The maturity can be captured either be qualitative, quantitative in a continuous or discrete manner (Facchini et al.,2019).

From literature, digital transformation and innovation has exponented the growth in study of digital BMs. A digital BM is one that provides service to customer, creates business value and offers a new frontier of a competitive advantage. Sehnem et al. (2019) studied maturity of BMs from a sustainability perspective and identified a five scale measurement on level of maturity. Kane et al. (2015) contributed by grouping maturity of companies' BMs in three stages: early, development and matured while Gill and Vanboskirk (2016) described digital maturity of BMs, based on four levels: sceptics, adopters, collaborators and differentiators. From their finding most of companies they did survey lied in the adopters and collaborators with only a few in differentiators.

Companies that seek to know the extent to which they have embedded digital transformation in their BMs, Berghaus and Back (2016) through cluster analysis developed a five stage maturity model. Characterizing a digital BM is the early Brousseau and Penard (2007) framework that consisted of three platforms: "intermediation,

assembling and Knowledge management.” Other framework includes: the MIT maturity framework that constitute of three phase: content, experience and platform and the VISOR framework that has five variables. Both frameworks come with a set of question that are used to measure the level of digital maturity of BMs.

For the purpose of this research, the VISOR framework is adopted and its descriptors are aligned to meet the research objectives. The VISOR model brings with it a set of elements as shown in table 1 and address unaddressed elements such as user experience, interface factors and customer valuation. Its composed of **V**alue proposition, **I**nterface, **S**ervice platform, **O**rganizing model and **R**evenue model. Each of the element has a set of question which for the purpose of this study are adjusted to measure the digital maturity of the liner shipping business. Advantage of this model is that it outlines the overall level of maturity and that of the individual elements

Table 1: Elements of the measurement model

ELEMENT	ELEMENT DESCRIPTION
1. Digital business model maturity (VISOR)	This refers to “level of development of a particular digital BM, observed to the relevant framework for digital BMs” (Supremic et al.,2021)
1.1 Value Proportion (VAP)	Seek to address why a given segment of customers could be willing to pay a price for an enterprise’s products and services. measurement here is the “value creation.” Composed of four descriptors: <ul style="list-style-type: none"> • Compelling (C1) – Extent to which a service or product satisfies the need of a customer. • Cohort (C2) - The number of customers in a given market segment who perceps the product or service meet their need. • Complementarity (C3) - Availability of other services and products that are interdependent of the customer need. • Co-creatability (C4) – the level to which customers could alter or add dimensions of digital services and products.
1.2 Interface (INT)	Describes the user experience in terms of: simplicity, ease of use, positive energy and convenience. It the determinant of success in delivery of product or service. The aim is to provide an extraordinary experience or the “WOW” experience. Has four descriptors: <ul style="list-style-type: none"> • Functionality (F1) – The range and types of interface interactions and their convenience in use. • Form factor (F2) – The customer perception of the interface. • Fluidity (F3) – The level of customization. That is provision of: personalization, control, intimacy and flexibility to the customer. • Forgiveness (F4) – The interface ability to auto-correct a user’s error.

<p>1.3 Service Platform (S.P)</p>	<p>This is the availability of an IT platform that facilitates the business process, value proportion and relationship to enable effective delivery of services and product.</p> <ul style="list-style-type: none"> • Architecture (A1) – Characterize the topology of software and hardware of service provision. • Acquisition (A2) – responds to question of whether to establish or piggy- back on existing technologies. • Access (A3) – describes the access of clients to its services (from walled garden to totally open)
<p>1.4 Organization model (ORG)</p>	<p>Defines how an organization, organizes its business processes, partnership and value chains for effective and efficient provision of products and services. has following descriptors:</p> <ul style="list-style-type: none"> • Process (P1) – defines how the core business processes are organized for delivery of digital products and services. • Partnerships (P2) – Nature and quality of business relationship enterprise engages in. • Pooling (P3) – The coming together and sharing of asset or level of compatibility and capability with partners
<p>1.5 Revenue Model (R.M)</p>	<p>Defines the way in which the enterprise makes money. Entails combining the value proportion, IT investments, delivery of product and services such that revenue exceeds cost and sufficiently attracts partners and customers. Entails:</p> <ul style="list-style-type: none"> • Pricing (P.R 1) – The pricing methodology • Partner revenue sharing (P.R 2) – The proration sharing amongst partners • Potential volume (P.R.3) – the level of demand of the enterprise products and services.

Note: Developed by author based on Biloshapka et al., (2016) and Zentner et al., (2021)

CHAPTER THREE: METHODOLOGY

Introduction

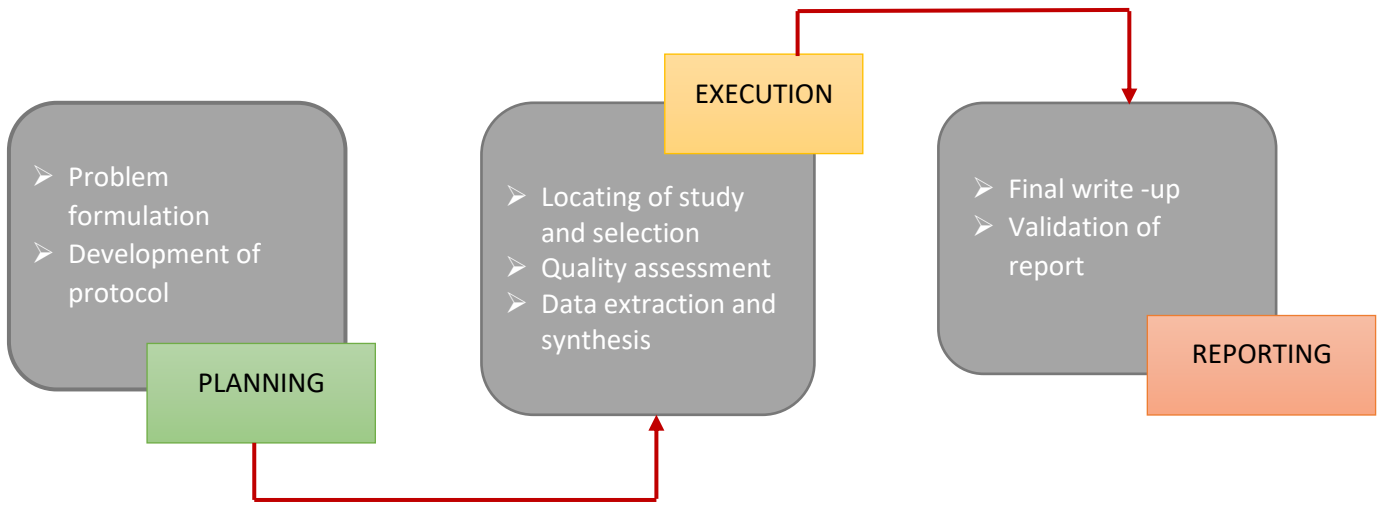
This chapter, presents the methodology applied in this paper. We considered the research approach, research design and steps followed. The paper adopts the proposed methodology of Tranfield et al. (2003), the systematic literature review (SLR) also known as research synthesis. The choice of it is factored by nature of study been explorative and the type of questions adopted. SLR is characterized by a series of multiple steps, which provides, a detailed and extensive coverage of systematized and unbiased works of many scholars, practitioners, and researchers in a single document. The advantage of this method is that, it attempts to reveal all the evidences pertaining subject in question and focuses on data reporting. This brings deeper understanding, new and advanced ideology, as opposed to narrative literature review that is considered to have a higher risk of biasness and systematic error as it focuses on concepts and theory (Aromataris & Pearson 2014).

The SLR is defined by the following features as highlighted by Aromataris and Pearson (2014).

- i) Clear articulation of the research questions and objectives.
- ii) A well-defined criterion for inclusion and exclusion.
- iii) Comprehensive search and Identification of all appropriate studies from the internationally recognized databases.
- iv) Presentation and Synthesizing of obtained findings.

To ensure we factor this, we segment our systematic literature review into three. That is: planning, execution and reporting as shown in figure 4.

Figure 4: Systematic review process



Note: Developed by author based on Campbell, (2014)

3.1 Problem Formulation

To establish a focused and systematic research we begin by framing a generalized research question that's highlights the gap as follows: How can liner shipping companies discover their capability and areas of improvement by accessing their internal efficiency and maturity of their individual functional, process and organization? To generate a detailed response and fill of this gap, we apply the CIMO logic (Context, Intervention, Mechanism Outcome). This enables us to identify four key aspects as follows: Under what condition **(C)** are the digital matured business models in literature. How are their influencing **(I)** the business behavior of the liner shipping companies? Which are the most relevant digital matured business models that mechanize**(M)** the today's shipping business environment and what has been the benefits, gaps and challenges out-coming **(O)** from their adoption? This leads to the following research questions:

RQ1 – What is the status and characteristics of a good business model for the liner shipping companies in literature?

RQ2 – Which mature business models been applied in the liner shipping?

RQ3 – Which is the appropriate digital business model for today's liner shipping?

RQ4 – What are the advantages and shortcoming associated with adoption of digital matured business models?

3.2 Development of Protocol

Any good research of quality requires adherence to and development of a protocol (O'Connor et al., 2014). The protocol outlines a step by step guidance, that ensures that the literature review to be conducted is consistent and clear all through. In the paper we consider a four staged process as shown in table 2.

3.3 Study Location and Selection

In the section aim is to locate, choose and appraise all relevant studies and information that could be of various types – (academic papers, books, practitioner materials and internet) and should be aligned to the particular research questions. Methods to use include: databases search, bibliography search and hand searches. The search begins by database citation, search strings, search convections and keywords. It can be done by use either simple operators such as: truncating characters, word association or exact phrase or Boolean logic: “and”, “or” and “and not” (Denyer & Tran field, 2009). The output of this is a comprehensive list of relevant study

Table 2: Protocol development structure

Step 1: Selection Of Relevant Papers					
<i>Methodology: key wording and different combinations of them</i>					
Keyword 1	Keyword 2		Databases		Selection criteria
<ul style="list-style-type: none"> ➤ Business models ➤ Maturity of business models ➤ Digital business models ➤ Measurement 	<ul style="list-style-type: none"> ➤ Shipping industry ➤ Liner shipping ➤ Container shipping ➤ Shipping business models ➤ Digitalization 	+	<ul style="list-style-type: none"> ➤ Google scholar ➤ Science direct ➤ Scopus ➤ WMU library 	+	Period – (2009 - 2022) Article language – English
Step 2: Content/Data Selection					
<i>Aim: removal of irrelevant articles</i>					
<ul style="list-style-type: none"> ➤ Title and abstract reading ➤ Full text articles 					
Step 3: Final Collection Of Articles					
<i>Focus:</i>					

<ul style="list-style-type: none"> ➤ liner shipping operational models ➤ Measure of their digital maturity 	
Step 4: Data Synthesis And Analysis	
<ul style="list-style-type: none"> ➤ <i>PRISMA</i> 	
+	
Step 5: Measurement Framework	

Note: Developed by Author

3.3.1 search phrases

This paper acknowledges the vital importance of the selection criteria in the research planning step. To obtain a well-rounded and defined research plan, we established a critical and transparent searching engine. It comprises of keywords 1 and 2 as shown in figure 2. Search strings adopted as follows: “digitalization” or “4.0” or “smart” and “business model” or “business archetype” and “liner shipping” or “container shipping” and “mature” and “maturity assessment” or “maturity appraisal”. The search strings consist of five parts. The first capture results from digitalization, parts two outline results from field of business models, part three warrants reduction of literature to those dealing with models in the liner shipping and the last two parts grantees’ narrowed literature results of maturity (models) and how this maturity is assessed. By this we manage to have an exhaustive collection of literature from all possible study locations.

3.3.2 Selection of Study

Here we sort to identify areas where we could explore and exploit our needed study. We consulted the following databases: Google Scholar, Science Direct, Scopus and the World Maritime Library. The choice of these databases was not spontaneous but was based on their ability to provide access to high quality publications and their rank. The databases are popular, up to date and of frequent use by practitioners, scholars and researchers. However, timing was a challenge in the writing of this dissertation and as a result article to be revived and synthesized were minimized and collection limited to books, journals and liners publications.

3.3.3 Screening for inclusion and exclusive

Upon compiling the reference list, each article is screened to decide which of the articles will be used for data extraction and analysis (Xiao & Watson, 2019). In this study we weed out articles whose content un-befits the research questions. The weeding out process is depicted in figure 5 based on PRISMA literature review. we do this in two approaches:

coarse sieving that is reviving of abstract and the refined quality assessment that entails full text reviewing (Xiao & Watson, 2019). Articles subjected to this are only the pre-reviewed and conference proceedings and must conform to the terms and conditions showed in table 3.

Our paper periods in the last 10 years (2012 – 2022). This enables us to capture how shipping business have been forced to transform given the extreme disruptions that have characterized the industry. They include: the post global financial crisis, the birth of industrial 4.0 (that introduced threat of born digital firms), the Covid- 19 pandemic and the recent Ukraine-Russia war. Thus we excluded articles:

- Not in the domain of liner shipping – for example, medicine or other maritime markets other than the liner.
- Not focusing on digital model maturity – some papers did focus of liner models but not on their digital maturity
- Articles characterizing a risk of bias and incorrect findings such as government publications, thesis and dissertations.

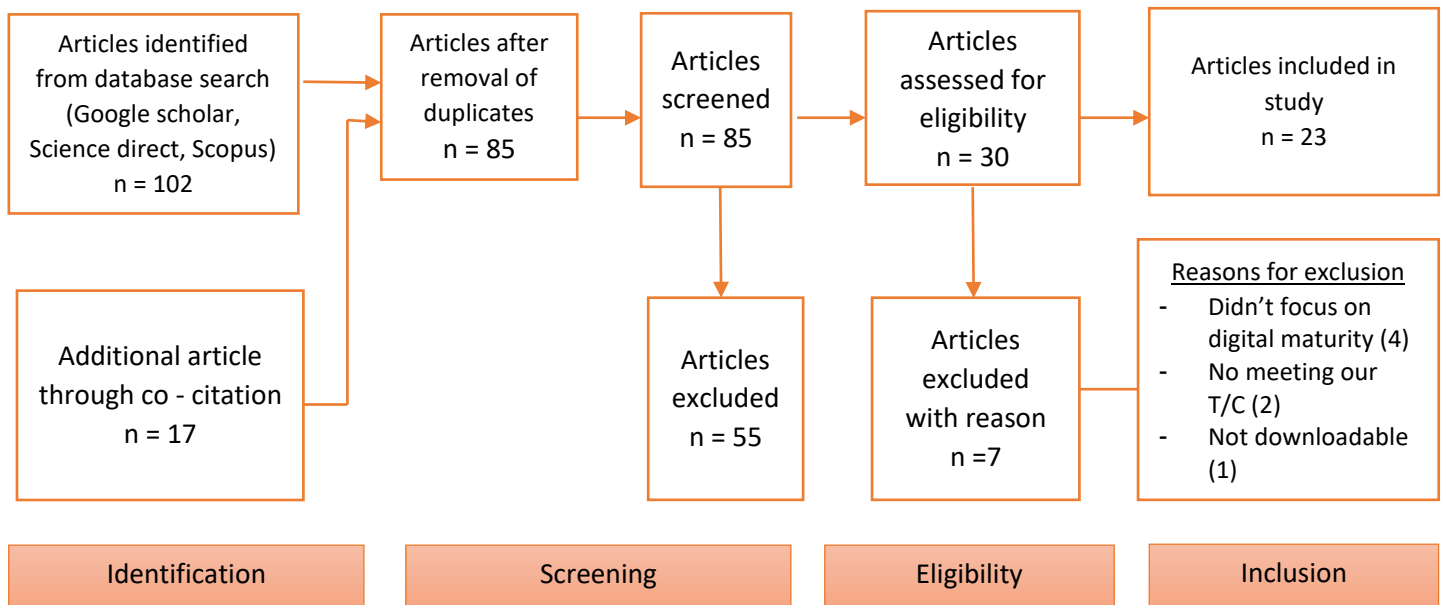
We included articles only covering digital maturity in liner business models and based on selected period.

Table 3: Term and conditions for article selection

NO	TERMS AND CONDITIONS
1.	Article must be covering: business models, digitalization, maturity of business models, measure of the maturity of digital business models in the shipping industry. Those focusing on liner shipping of greater advantage.
2.	Articles must pre-revived and published in academia
3.	Article should range in the period of 2012 - 2022
4.	The authors of the articles must be renowned. Their professional background and experience is closely monitored. 10 years taken as the minimum requirement
5.	Article should be published by recognized publisher and should have at least a quartile of Q2 and a high indexation
6.	The articles need to be in full text format
7.	The publication language of the article should be English

Note: developed by author

Figure 5: PRISMA flow of systematic literature review



Note: developed by author, adopted from (Ochoa-Urrego, 2021).

3.4 Quality Assessment

At this stage, preparation of article considered relevant for data extraction and synthesize is finalized. The articles are fine sieved, to free them from methodological biasness through an internal validity check (Xiao & Watson, 2019). It's of essence to create awareness and acknowledge the differences in study quality rather than just a no and yes cut-off (Okoli & Schabram, 2010). To ensure minimized data inaccuracy and biasness, data is gathered through internationally recognized databases namely: google scholar, Scopus and science direct. As of the selection process reliability, a systematic and guiding approach was used as shown in figure 1 and the articles had to conform with the terms and conditions identified in table 1. This is attributed from the concern that secondary data quality is never enough but it could be sufficient if supplemented with score of study according to the different standard forms (Okoli & Schabram, 2010).

3.5 Data Extraction and Synthesis

At this point of time aim is to obtain the raw material that will be synthesizing so as to create meaning. Information/data is systematically collected in accordance to the research question formulated at the protocol stage. At this stage, the measurement framework (VISOR) develop for the study is presented. The framework has a series of question which we use to obtain data on the level of digital maturity of liner shipping BMs. The data is

collected from the top 20 leading liner shipping companies. With the data in place, it is then aggregated, organized, discussed and compared. The study adopts the descriptive analysis where both quantitative and qualitative methods are employed.

3.5.1 The Measurement Framework

This study employed a structured online survey questionnaire whose questions were developed from the VISOR sub-element or in other words descriptors as shown in table 1. Each of the question has a probable response of no, in progress or yes. In order to obtain comprehensive and comparable results the responses are acquitted with a weightage factor of 1, 2 and 3 respectively. The survey is conducted on the top 20 liner shipping companies as per the Alphaliner report 2022 (see figure 6). Given that main objective of this study is on the digital maturity of LSC and the level of its implementation, we scale our data collection to the LSC webpages, their social media platforms: Facebook, LinkedIn, twitter and their official publication. The study in particular considers: the ratings awarded to a company, the comments given by clients whom have an experience of service with the companies, its number of followers and repost and tags made by the platform users, the products and services their offer and the level of diversity. In addition to this the study checks the rate at which the LSC update their online platform and the time taken to respond to feedback raised digitally by their clients. Table 4 shows the elements considered relevant in measuring the digital maturity of LSC business models with its associated set of questions.

Figure 6: Top 20 liner shipping companies

Rank	Operator	Teu	Share	Existing fleet	Orderbook
1	Mediterranean Shg Co	4,475,278	17.4%		
2	Maersk	4,250,047	16.5%		
3	CMA CGM Group	3,320,391	12.9%		
4	COSCO Group	2,874,654	11.1%		
5	Hapag-Lloyd	1,764,554	6.8%		
6	Evergreen Line	1,581,205	6.1%		
7	ONE (Ocean Network Express)	1,497,162	5.8%		
8	HMM Co Ltd	818,075	3.2%		
9	Yang Ming Marine Transport Corp.	696,543	2.7%		
10	Zim	515,902	2.0%		
11	Wan Hai Lines	439,541	1.7%		
12	PIL (Pacific Int. Line)	297,163	1.2%		
13	SITC	150,635	0.6%		
14	KMTC	149,255	0.6%		
15	IRISL Group	143,468	0.6%		
16	UniFeeder	142,051	0.6%		
17	X-Press Feeders Group	130,737	0.5%		
18	Zhonggu Logistics Corp.	113,220	0.4%		
19	TS Lines	107,139	0.4%		
20	SM Line Corp.	93,410	0.4%		

Note: Adapted from Alphaliner report August 2022

<https://alphaliner.axsmarine.com/PublicTop100/>.

Table 4: Methodology of measuring the variables

Element	Elements measurement criteria
1. VISOR	Is computed as the average of all the values from 1.1 to 1.5. The higher the average the more matured is the digital business model.
1.1 VAP	We conduct a qualitative research, based on a No, in progress and Yes criteria and provide a possible explanation on it. The following questions are used: C1: The customers do present a will to pay a premium on their services and product C2: Do their product and services have the ability to attract a huge number of customers in comparison to their competitors C3: Our existing products and services are interdependent in consumption C4: clients constantly engage in creating our digital products and services
1.2 INT	We conduct a qualitative research, based on a No, in progress and Yes and provide a possible explanation on it. The following questions are used: F1: Do they have a platform that facilitates or enables access to a range of services? F2: client percepts that products and services offered to them creates a “WOW” experience? F3: The company offers customer control, personalization and flexibility F4: Our platform offers an auto correction to the customer
1.3 S.P	We conduct a qualitative research, based on a No, in progress and Yes and provide a possible explanation on it. The following questions are used: A1: Our customers, partners and process can easily integrate in our digital platform A2: We are in constant improvement of our digital platform A3: Our digital platform are easily accessible, easy to use and of quality
1.4 ORG	We conduct a qualitative research, based on a No, in progress and Yes and provide a possible explanation on it. The following questions are used: P1: Our business strategy and process is excellently aligned with the market conditions P2: We have established significant partnership/alliances P3: We constantly engage in pooling P4: Partnership creates a significant business value to our organization
1.5 R.M	We conduct a qualitative research, based on a No, in progress and Yes and provide a possible explanation on it. The following questions are used: P.R 1: We consider our price mechanism as our main competitive advantage P.R 2: We have a clearly articulate way of retaining and revenue sharing with our partners P.R.3: Customer are more likely to choose us than our competitors

Note: Author's creation

CHAPTER FOUR: EMPIRICAL ANALYSIS

4.1 Data Analysis and Findings

This paper conducted an empirical research based on research synthesis. By applying the search strategy, an initial collection of 102 articles was obtained and an addition of 17 articles retrieved from forward and backward scoping. Generally, this indicated a limited literature in the field of digital maturity of business models. The collection was then subjected to the inclusion and exclusion criteria. This resulted to an identification of 23 relevant articles shown in table 5. This seems to suggest that, indeed shipping is a conservative industry. Despite of the pressure given by the digital era, the concept of DMBMs is still unheard-off. This evidenced by us only finding one article out of the 23 articles focusing on BMs and non in DMBMs.

Table 5: Relevant articles used for the study

Article	Author	Keyword	Sector
A1 - Digital Maturity Models: a systematic literature review	Urrego et al., 2021	Digital maturity, digital transformation, digital strategy, service provider, S.R	Service
A2 - Business models and dynamic capabilities	Teece, (2018)	Dynamic capabilities business model design, organization design, strategy, intellectual property	General
A3 - Balancing Digital Maturity and Operational Performance - Progressing in a Low-digital SME Manufacturing Setting	Grooss et al., (2022)	Digitalization; Industry 4.0; Digital Maturity; Operational Performance	SMEs
A4 - Development of assessment model for industry 4.0	Sener et al., (2017)	Industry 4.0, Industrial Revolution, Industrial Internet of Things, Maturity Model	General
A5 - Measuring Digital Business Models Maturity for SMEs	Helena et al., (2021)	digital business models, digital business model maturity, digital maturity, digital business models for SMEs, measurement of digital business models maturity	SMEs

A6 - Mastering the digital transformation process: business practices and lessons learnt.	Ivančić., (2019)	Digitalization, digital process transformation	General
A7 - Development of an industry 4.0 maturity model for the delivery process in supply chain	Asdecker and Felch (2018)	Logistics, Supply chain management, Value chain	Shipping
A8 - The digital maturity model 5.0	Gill and Vanboskirk, (2018)	Digital maturity, model 5.0	General
A9 - Digital maturity is a product of strategy, culture and leadership.	Gerald et al., (2015)	Digital - strategy, culture and leadership	General
A10 - Stages in digital business transformation: results of an empirical Maturity study	Berghaus and Back, (2016)	Digital transformation, maturity model, digital strategy, organizational change, transformation strategy	General
A11 - Construction industry needs an Airbnb of its own	Otto Alhava et al., (2017)	Business model, construction industry, disruption, pipeline, platform	Construction industry
A12 - A maturity model for accessing industry 4.0 readiness and maturity of manufacturing enterprises	Selim and Wilfred (2016)	industry 4.0, maturity models, strategic management, change management	Manufacturing
A13 - Organizational BIM maturity models and their applications: a SLR	Alankarage et al., (2022)	Building information modelling, maturity models organizations, construction industry	Construction industry
A14 - Digital maturity: conceptualization and measurement model	Rosemann, (2019)	Digital maturity digital capabilities, measurement	General

A15 - A model assessing maturity of industry 4.0 in banking sector	Bandara et al., (2019)	Industry 4.0, banking 4.0, maturity model, maturity assessment	Banking
A16 - Balanced scorecard for digital transformation of global container shipping lines	Maydanova et al., (2019)	Container shipping, digital transformation, value- based management	Container- shipping
A17 - A maturity assessment for the business model of start-ups	Poandl et al., (2019)	business models, maturity, maturity assessment, maturity models, business model maturity, business model maturity assessment, business model innovation, business model evaluation	General
A18 - Digital transformation maturity: a systematic review of literature	Teichert, (2019)	SRL, Digital transformation, Digital maturity model, digital transformation maturity, digital culture	General
A19 - Contextualizing the outcome of a maturity assessment for industry 4.0	Colli et al., (2018)	Digital transformation, maturity assessment, problem based learning, industry 4.0, smart manufacturing	Manufacturing
A20 - VISOR: A unified framework for business modelling in the evolving digital space	Sawy and Pereira, (2013)	Business modelling, digital space	General
A21 - Literature search of key factors for the development of generic and specific maturity models for industry 4.0	Cristiano de Jesus (2020)	Industry 4.0, maturity models, systematic literature	SMEs
A22 - Three stage maturity model in SME's towards industry 4.0	Ganzarain and Errasti (2016)	SMEs, industry 4.0, diversification strategy, maturity model	SMEs

A23 - The significance of maturity models application in manufacturing towards adaption of industry 4.0:a review	Meshack et al.,(2019)	Industry 4.0, maturity models, decision making, industry 4.0 pillars, manufacturing	Manufacturing
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Note: Author's creation

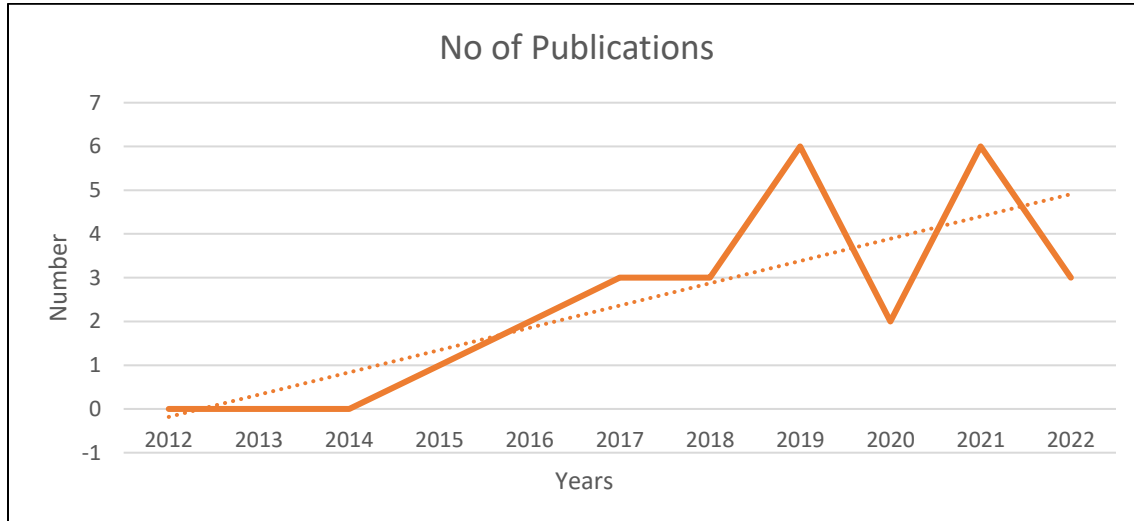
4.1.1 Trends in Publications

Since the inception of industry 4.0 in Germany 2011, the last decade has been characterized by a change in the way businesses have been carried out. The change is attributed to the intense digital transformation and technological innovation. A need to align business strategies to these developments has emerged. Traditional BMs are continuously being squeezed out and replaced with platform based BMs.

As a consequence, an overwhelming attention from practitioners and scholars has emerged as evidenced in figure 7. The attention has particularly been on maturity of BMs. Only firms with matured business model can weather the uncertainty and volatility presented by the current business environment (Biloshapka et al.,2016).

From the graph, year 2019 happens to be the peak year, demonstrating a growth of importance on topic. A drop is witnessed in 2020, which can be associated with the slowdown of company operation during the pandemic. It followed by an exponential growth of articles in 2021, which equates all articles from 2012 to 2018. This could be explained by lessons learnt during pandemic and the realization of the benefits tagged with embedment of digital technologies in firm's ways of operation. 2022 is characterized by a drop of articles but it too early to comment on such a trend, since study is done in same year and therefore its prudent that the year is discounted. To be noted also is that, in terms of article distribution with regards to publication type, majority of them are journals at 87.5% followed by conference preceding at 12.5%.

Figure 7: The distribution of articles on years of publication

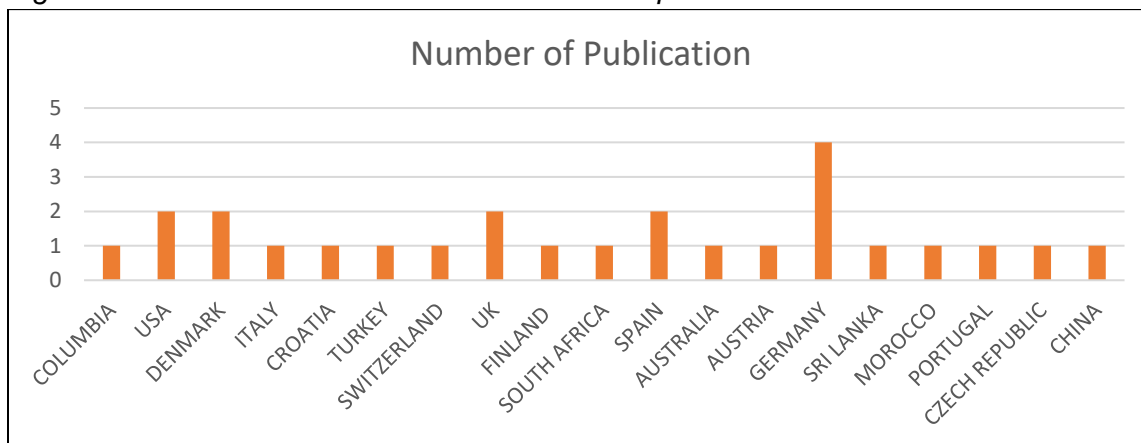


Note: developed by Author

4.1.2 The Location of Publications

Given that shipping is global, aim of study was to have a diversified overview of matured BMs and to find out which among them could be applied and measured in shipping. Figure 8 shows a probable achievement of this. We had at least a representation of articles from each continent: Europe -14, Asia - 2, Africa - 2, North and South America - 4 and Oceania - 1. The geographical distribution of articles is an indication of a growing global interest in given area of research. The aspect of Europe leading in number of publication (14 articles) could perhaps be explained by role played the EU's digital strategy that aims at transforming the work of people and business in aid of achievement of a climate – neutral Europe by 2050.

Figure 8: The distribution of articles on location of publication



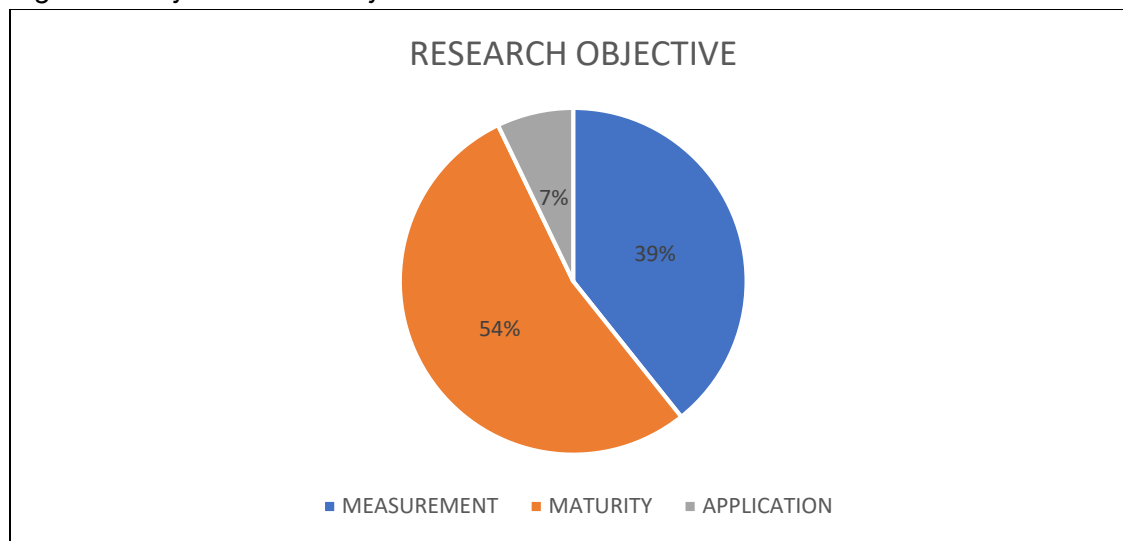
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4.1.3 Research Objectives in the Research Area

Our analyses of literature led us to identification of three major research objectives which are: maturity of BMs at 52%, measurement of BMs at 41% and Application of BMs at 7% as shown in figure 9. Majority of the articles tend to focus on providing an understanding of what it takes to have a matured business model and provision of a framework that can be used by firms to access their level of maturity.

This evidences a lesser effort in regards to assessing their digital level of maturity. In addition, it is noted that a huge gap does exist between the application, mature models and their measurement criteria. This can be explained by the fact that majority of the authors tend to illustrate the application through methods such as case study, questionnaire surveys or interviews. Example is Ivancic et al. (2019) whom they develop a framework of digital transformation model and implemented it in three different companies.

Figure 9: Major research objectives



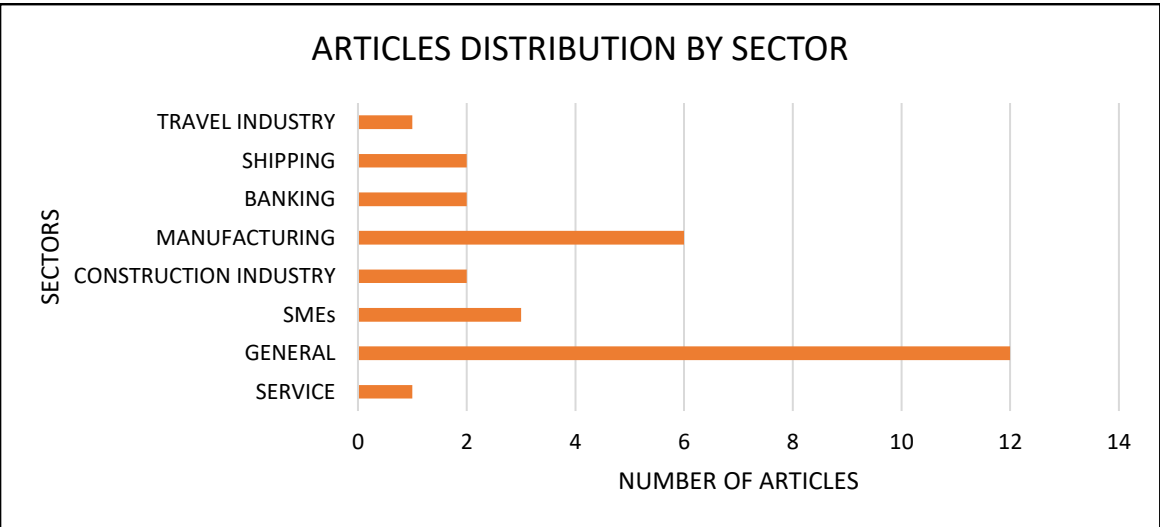
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4.1.4 Sectorial Distribution of Articles

According to UNCTAD (2020) manufactured goods tend to make up the biggest composition of goods transported by liners. Holding the exclusion criteria constant, articles focusing on manufacturing industries were the highest in number. This could perhaps mean a good harvest for liners if they invested in collaboration and digital alignment as there seems to be an assurance of a demand. From the articles we revealed, 12 of them had no specific point of focus in regards to measurement of matured digital BMs, they were followed by manufacturing at 4, SMEs at 3, shipping, banking and construction

industry all at 2 and lastly the travel and service industry each with one article as shown in figure 10. To be noted here is that all the given sectors are in one way or the other related to shipping. for example, banking – ship financing, construction – ship building and service – valuation of the customer. Thus if they are considering accessing their digital maturity, then shipping been a close companion businesswise cannot be left behind.

Figure 10: Sectorial distribution of articles



Note: Author’s creation

4.1.5 Identified Maturity Models, their Dimensions and Research Designs

Our literature analysis revealed a collection of 85 maturity models which were developed, applied and evaluated on a sector-specific bases or a generalized base. From the 85 models, only 20 of them were considered to most fit in responding to our research questions and are shown in table 6. The models presented an average of 5 and a standard deviation of 2 in regards to the dimensions characterizing them.

Taking a look at the motivation of the models, only 3 of them had a direct focus on the assessment of the digital maturity of BMs. They include the MIT model, VISOR model and the 360 model. 12 of them focused on model maturity and rest on traits of a matured model. This revealed to us that despite us been in the era of digitalization, literature on assessment of digital maturity of BMs remains to be scarce.

The models identified, differed slightly but did present a common trend. They all began with the question, how do we deliver value to our customer? and end with how then do we make money from doing that? This was evident from dimension used. Similar dimensions were used only that different names were used for same dimension. For example,

“strategy” for “governance”, human capital for either “people,” “employees,” “expertise” or “competence.” To note, was that almost all the models had customers, process and governances as their key dimension, something which justifies our reason of choosing them, since these dimensions are of vital importance to the liner shipping industry.

By reviewing the articles, we noticed that most common methods used to collect data for studying the models was through case study, whose reason still remains unclear to us. However, traces of SLR, surveys and interview were also present. A generally explanation of choice of these methods could be associated by the need of not just developing the model but also ascertaining that the models were applicable in the real context.

Table 6: Maturity models identified, their dimension and study design

ARTICLE ID	AUTHOR	MODEL	NUMBER OF DIMENSIONS	DIMENSIONS	RESEARCH DESIGN
A1	Urrego & Reyes, (2021).	Archimate 3.0.1	6	Strategy layer Business layer Application layer Technology layer Physical layer Implementation and migration layer	Comparative research
A2	Teece, (2018)	The Good Business Model (GBM)	5	User need Technological enabled Value capture Human capital Non-imitational	Qualitative research
A3	Grooss et al., (2022)	The toolbox industry 4.0	2	Process product	Case study
A4	Helena et al., (2021)	The MIT Model	3	Content Experience Platform	Questionnaires
A5	Ivančić., (2019)	The Digital Transformation Model	7	Strategy People Organization Technology Innovation	Case study and interviews
A6	Sener et al., (2017)	Industry 4,0	5	Asset management Data governance Application management	SLR

				Process transformation Organizational alignment	
A7	Asdecker and Felch, (2018)	Delivery process maturity model (DPMM) 4.0	3	Ordering process Warehousing shipping	Design science research
A8	Gill and Vanboskirk, (2017)	Forester's digital maturity model 5.0	4	Culture Technology Organization Insights	Case study and interviews
A9	Berghaus and Back, (2016)	Digital Maturity Model (DMM)	7	Customer experience product innovation strategy organization process digitalization collaboration information technology culture and expertise	Interviews Focus group Survey interviews
A10	Otto Alhava et al., (2017)	Platform Based Model	3	Audience building Matchmaking Tools and services	Case study
A11	Selim and Wilfred (2016)	Schumacher maturity model	7	products and services, Technology and resources, Strategy and organization, Operations Customers, Governance, employees	Content analysis
A12	Alankarage et al., (2022)	Business information maturity (BIM)	5	Organization It infrastructure People Process and procedure Information and data	SLR

A13	Rosemann, (2019)	Rosemann Digital Maturity Model (RDMM)	8	Strategy Leadership Market Operational People Expertise Culture Governance Technology	Interviews
A14	Bandara et al., (2019)	The banking maturity model	7	products and services, Technology and resources, Strategy and organization, Operations Customers, Governance, employees	Content analysis
A15	Maydanova et al., (2019)	Canvas business model	4	Customer relationships, value proportion Resource activities and capabilities	Design science approach
A16	Colli et al., (2018)	360 digital model assessment	5	Technology Governance Connectivity Competences Value creation	Case study
A17	Poandl et al., (2019)	Business model maturity assessment	5	Adaption and change of BM Customers and markets Value proportion Resources activities and capabilities Cost revenue and financing	Design science approach
A18	Teichert, (2019)	DX – capability maturity model	4	Strategic governance Information and technology Digital process transformation	SLR

				Workforce management	
A19	Colli et al., (2018)	Acatech industry 4.0 maturity model	4	Resources Information systems Organizational structure culture	Case study
A20	Sawy and Pereira, (2013)	VISOR model framework	6	Value proposition Interface Service Platform Organizing Model Revenue Model	Case study

Note: developed by author based on (Ochoa-Urrego, 2021)

4.2 Measurement Framework Results

Table 7 shows the responses to the measurement framework questions as highlighted earlier in table 4. The results are then presented graphically in figure 11. From here it observed that the level of digital maturity is mainly influenced by two factors: the depth of scale and the niche specialty of a LSC. Reason to this is because, most digitally matured LSC are those that command a large market share such as Maersk line that takes the lead, followed by MSC, CMA-CGM and COSCO. On the other hand, we have niche specialist LSC such as ONE, ZIM, Unifeeder and SM line corp. These liners specialize and monopolize service provision to a specific region. They have managed to adopted a digital operating model that responds to the local needs. According to BCG (2018) such LSC are able to break even and attain high profitability, which gives them a competitive advantage over their peers who are the medium sized LSC.

Table 7: Measurement framework results

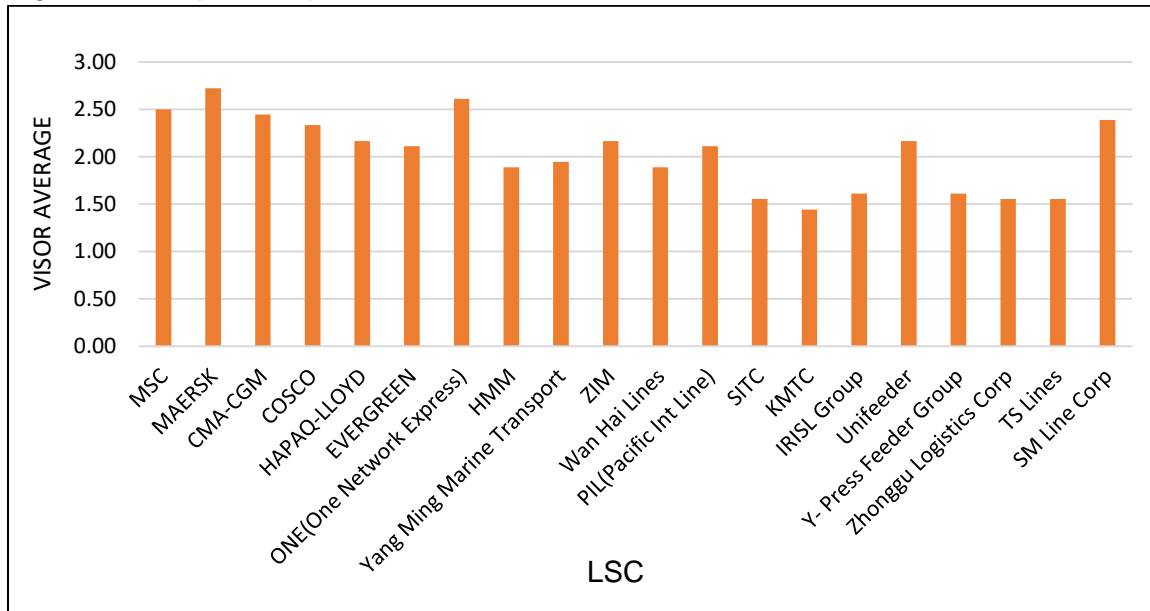
	1.1 VAP				1.2 INT				1.3 S.P			1.4 ORG				1.5 R.M		
LINERS	C1	C2	C3	C4	F1	F2	F3	F4	A1	A2	A3	P1	P2	P3	P4	P.R1	P.R2	P.R3
MSC	★	✓	✓	★	✓	★	✓	✗	✓	★	✓	✓	✓	✓	✓	✗	★	✓
MAERSK	✓	✓	✓	★	✓	✓	✓	★	✓	✓	✓	✓	✓	✓	✓	✗	★	✓
CMA -CGM	★	✓	✓	★	✓	★	✓	✗	✓	★	✓	✓	✓	✓	✓	✗	★	★
COSCO	★	✗	✓	★	✓	★	✓	✗	★	✓	✓	✓	✓	✓	✓	✗	★	★
HAPAQ-LLOYD	★	★	✓	★	✓	★	★	✗	✗	✓	✓	✓	★	✓	★	✗	★	★
EVERGREEN	★	★	✓	✗	✓	★	★	✗	✗	★	★	✓	✓	✓	✓	✗	★	★

ONE (One Network Express)	✓	✓	✓	⊛	✓	⊛	✓	⊛	✓	✓	✓	✓	✓	⊛	✓	✗	⊛	✓	
HMM	⊛	⊛	⊛	✗	✓	✗	⊛	✗	⊛	⊛	⊛	✓	⊛	⊛	⊛	✗	⊛	⊛	
Yang Ming Marine Transport	⊛	⊛	⊛	✗	✓	✗	⊛	⊛	✗	✗	✓	✓	⊛	⊛	⊛	✗	✓	⊛	
ZIM	⊛	⊛	⊛	✗	✓	⊛	✓	✗	✓	⊛	✓	✓	⊛	⊛	⊛	✗	✓	⊛	
Wan Hai Lines	⊛	✗	✗	✗	✓	⊛	✗	✗	✓	✗	⊛	✓	⊛	⊛	✓	✗	✓	⊛	
PIL (Pacific Int Line)	⊛	⊛	⊛	⊛	✓	⊛	✓	⊛	⊛	⊛	⊛	✓	⊛	⊛	⊛	✗	⊛	⊛	
SITC	✗	⊛	⊛	✗	⊛	✗	✗	✗	⊛	✗	⊛	⊛	⊛	✗	⊛	✗	✓	⊛	
KMTC	✗	⊛	✗	✗	⊛	⊛	⊛	✗	✗	⊛	⊛	⊛	✗	✗	✗	✗	✗	⊛	
IRISL Group	⊛	⊛	✓	⊛	⊛	✗	✗	✗	✗	⊛	⊛	⊛	✗	✗	⊛	✗	✗	⊛	
Unifeeder	⊛	⊛	✗	✓	✓	⊛	✓	✗	⊛	⊛	⊛	✓	✓	✓	✓	✗	✗	⊛	
Y-Press Feeder Group	⊛	⊛	✗	✗	⊛	⊛	✗	✗	✗	⊛	⊛	⊛	⊛	⊛	⊛	✗	✗	⊛	
Zhonggu Logistics Corp	✗	⊛	✓	✗	⊛	✗	✗	✗	⊛	✗	✗	⊛	⊛	⊛	⊛	✗	✗	⊛	
TS lines	⊛	⊛	✓	✗	⊛	✗	⊛	✗	⊛	✗	⊛	⊛	✗	✗	✗	✗	✗	⊛	
SM line corp	⊛	✓	✓	✓	✓	⊛	⊛	✗	✓	⊛	✓	✓	✓	✓	⊛	⊛	✗	⊛	✓

Note: Author's creation.

Key : Yes - ✓ , No - ✗ , In progress - ⊛

Figure 11: Graphical representation of the measurement framework results



Note: author's creation

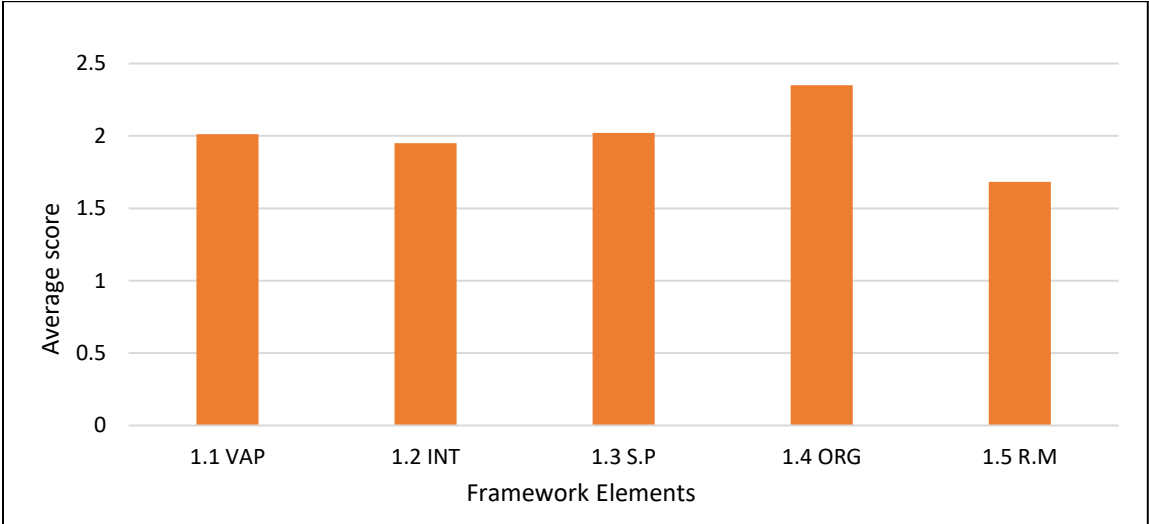
The study identified several opportunity areas that needs to be improved digitally. Such areas include: Interface under the aspects of form factor (F2) that entails the level of customization. Most LSC still lag or at the infancy stages in providing their customers with the personalization, intimacy and control of the process. The covid-19 catalyzed the F2 and LSC are now engaged in developing mobile apps such as captain peter for Maersk and myunifeeder for Unfeeder shipping line. Such platforms enable customers to keep an eye of their cargo as and when on transit, reduces the hassles and complexity associated with shipping. For example, with captain peter customers can monitor the temperature conditions in their container, humidity and carbon dioxide level and be able to respond accordingly. Through such a platform the customers actively participate in creating digital products and services which is commonly referred as User Generated Content (UGC) which according to Spremić et al. (2021) has been a major element of competitive advantage. The other is the forgiveness (F4) where no LSC exhibit a way in which autocorrection could be done in the event a customer made an error. Such include cancelling a booking and wrong detailing on the bill of lading.

As shown in figure 12, the revenue model was the least digitalized. It remains to be challenging on how LSC can mass profits given the perfect competition presented by the unprecedented and volatile market (MA, 2021). Services and product their offer are more or less the same but how digitally and differentiable their offer them, remains to be the key

to break even. LSC have continuous been conservative in the need to digitize their revenue flows and how dividend is shared among partners. Information on this is hardly available.

Positive to note is the high level of the organization model element. This could be explained by the reaction nature of LSC. The current environmental conditions of shipping industry subjects' liners in joining strategic alliances. The primary aim has been to optimize and to make sound decisions on operations by exchanging information with regards to: vessel operation, terminals and ports charges (Cariou et al., 2022)

Figure 12: Graphical representation of the measurement framework elements



Note: author's creation

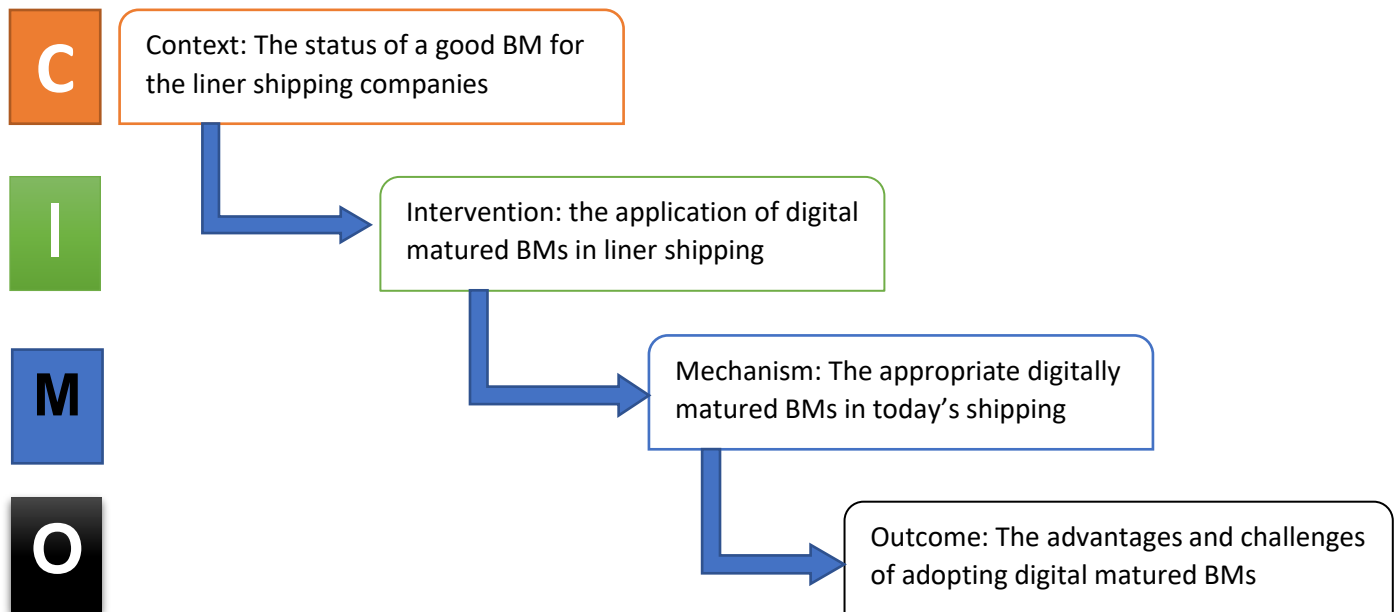
CHAPTER FIVE: DISCUSSIONS

Introduction

This chapter presents the response of the study research question as per the findings from the literature reviewed. Digitalization in shipping is still at its infancy stage. However, with the realization of its capability and the loose end that the industry could be standing on, its concept cannot be ignored. This has been occasioned by the increasing pressure and threat been posted by the digital born industries such as Amazon and Airbnb, the today's fragmented system and the modern customer who is demanding for a better experience. To counter this was the establishment of the Digital Container Shipping Association (DCSA) in 2019, a year identified as the year that had the highest number of publication on digital maturity.

The relevance of topic in the modern business has attracted a lot of publications. It has been quite challenging in identifying a model currently been applied, as well as analyzing the status of digital maturity for the LSC. To the best of our knowledge, there still exist no measurement framework that can be used to measure or benchmark the digital maturity of liner shipping BMs. Guiding in the response of the identified gap, the study adopts the CIMO model which is illustrated in figure 13.

Figure 13: CIMO Model



Note: Author's creation

5.1 Context

The context here is that, for LSC to analyze their level of BMs digital maturity, first and foremost, they should seek to ensure that they have a sufficiently good BM that is capable of running the operations of a shipping company effectively and efficiently. This raises the question of what entails a good BM and what has been the extent of its research in literature? Responding to this is our first research question *RQ1*:

“What is the status and characteristics of a good business model for the liner shipping companies in literature?”

The concept of a business model can be termed as a discipline on its own. Findings from literature suggests that this area has been explored immensely as evidenced by the numerous number of scholars and practitioners as illustrated in figure 7. A lot has been discussed of what exactly a BM is as presented in section 2.2. However, when it comes to the characteristics of a good business model with specificity to the shipping industry it becomes ironical that the results are relatively low, despite the fact that shipping is a global industry and makes part of our everyday life. Between the years of 2012 and 2022, no article was found specifically focusing on traits of a good business model for the LSC. 2 articles were found closely relating to shipping and one that explicitly focus on what makes a good BM but on a general approach. These articles were all based in Europe, a continent that had the highest interest (61%) in digital business model as illustrated in figure 8.

A lot of difficulty was experienced in sourcing the relevant article for this study. In order to get adequate number of relevant articles, forward and backward scoping was adopted. This made the first impression about the status of research in the given area. Based on the above experiences, it seems to suggests that the research on this subject matter is very limited. Supporting this notion is Manuel (2021), where he mentioned that in Sweden a country that neighbors the largest liner shipping company (MAERSK) in the world, IKEA among its main customers is much more known in comparison to it. It's therefore recommended that a lot of research still needs to be conducted in this area for the purposes of having a resonate way which liner shipping BMs can be orchestrated.

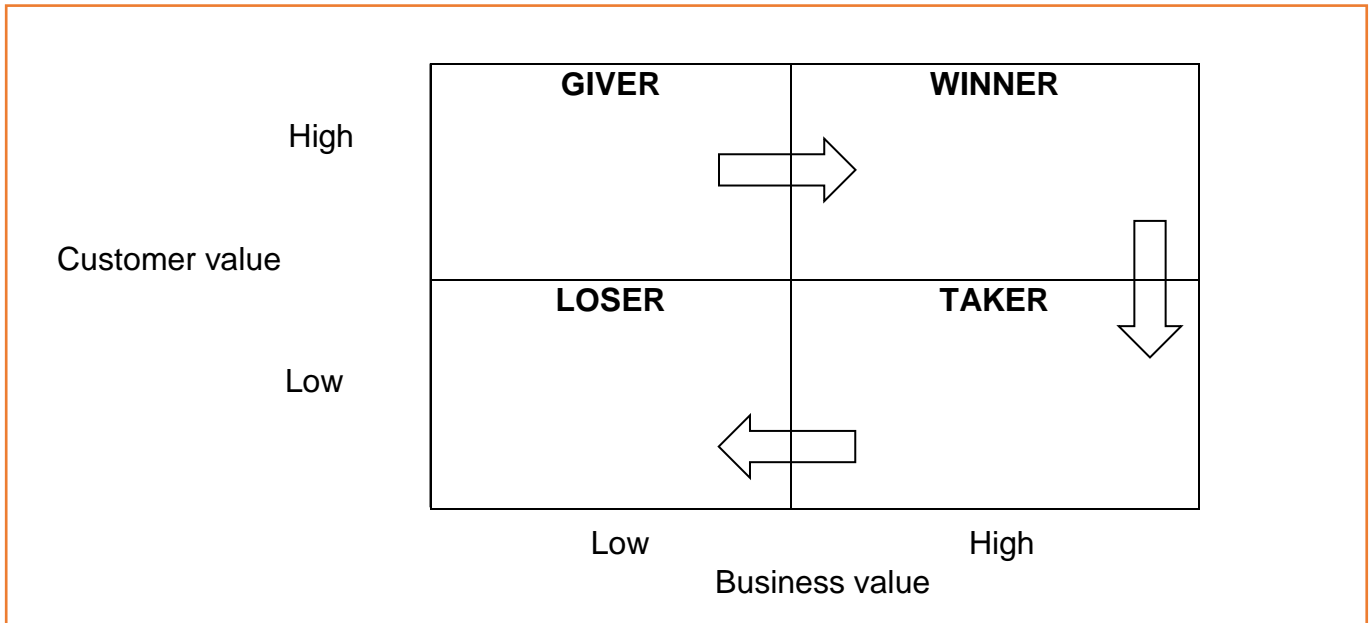
The identification of the 20 digital modes in literature suggests existence of a lot of publication regarding assimilation of digital technologies into the business modeling. However, the models exhibited a missing link of “what entails a good business model.” In response to this, we adopt the value matrix mode that juxtaposes the two critical dimension

of a good business model that is: Revenue Model and Operating Model. The two fundamental questions that LSC must ask themselves are:

1. What business value do their business model create? – This refers to the potential of value capture. It defines a LSC earning potential expressed by the gross margin (EBITDA) and the application of capital and investments using the measurements of ROE, ROI and ROA. It's needed that the model creates value to the liner business, create wealth to its stakeholders, retain profits and its economic value and margin should not all go to its customers and suppliers or in other words a there should be balanced monetization scheme (Biloshapka et al.,2016). For example, in the second quarter of the year 2022, Maersk CEO Soren Skou during an interview with CNN 3rd August 4, 2022 said that *“the company revenue growth was by 52% which registered a profit of \$21.7B despite the disruption in the supply chain, port congestion and labour shortage.”* Ultimately, this reflects an earning potential of a BM founded on an efficient monetization scheme, proper resource allocation and implementation.
2. What customer value is delivered by the liner BM? – The idea here is on solving the customer problem and satisfying his/her need in the best possible ways. Every LSC talks of having highest customer value but the hard part is if their customers thinks in same line as them, in whatever their do receive relative to cost. To be noted is that customer value is not about low cost but having best performance in all dimensions of the customer value. Example is the Tesla company that offer a car with superior performance, they do charge premium for it but still get flooding orders of it. Another is Uber cabs that do charge lower price as compared to their incumbents their investment on the customer valuation had promoted their enormous growth.

In conclusion we suggest that LSC must access if their model sufficiently respond to these two fundamental questions before proceeding to access their digital maturity. The two question yields the practical diagnostic tool – (the value matrix) as shown in figure 14. The Model has 4 quadrants that characterize the BM and its BM life cycle.

Figure 14: Business model value matrix



Note: Adopted from (Biloshapka et al., 2016)

- Giver – Usually at start of business. the model gives more than it gets. It excels in customer value yet their number is small and result is an unhappy shareholder. The model fails to deliver business value since it aims at attracting customer at its own expense.
- Winner – after bleeding in giver stage some companies manage to break even into the winner stage. Example is Facebook. Here the company enjoy optimal customer value (a happy and satisfied customer) as well as optimal business value (high and well- accepted profits). Example of this are: Apple, Tesla and the Singapore port. To be noted here is that no company last in this stage forever. A serious mistake in customer or business value can slip it into taker or give if no efforts are made to retain position.
- Takers – These are companies' whose BMs hang on their prominence. They achieve high profit without providing outstanding customer valuation. It could be explained by their high brand value, past successes and reputation. The position is fragile and could likely lead to loser. Their ability to maintain this position is mainly inflicted by government secured monopoly or market anomalies. Most of shipping companies tend to lie in this quadrant.
- Losers – these are companies whose BMs fail to offer customer value and business value. Characterized by unhappy customer and a failure to secure ROI.

Major reason for this is lack of creativity and failure to adjust their BMs. In other words can be termed as the fallen giants of the disrupted industry. Example of this is the legend blackberry phone company. All shipping companies need to be very vigilant not to fail in these stage especially with the raising level of digitalization and the inception of digital born industries such as the Amazon and Airbnb.

5.2 Intervention

Intervention refers to the measures or purposive action that are undertaken so as to solve a given problem or need and influences the outcome. In this subsection the paper seeks to discuss the measurement frameworks of digital maturity of liner shipping BMs. Question to respond to is:

RQ2: Which models are being applied by liner shipping companies in measuring their digital business model maturity?

To the best of our knowledge in the given timeframe of this study, the results of RQ2 indicated that there existed no measurement model for the digital maturity for the liner shipping BMs. Out of the 23 article that we reviewed, none of it focused on the liner shipping companies, either on a general or specific note. One article (Maydonara et al. 2019) however did relate to aim of the study. They studied the balanced scorecard for digital maturity in container shipping on the sector of information system architecture.

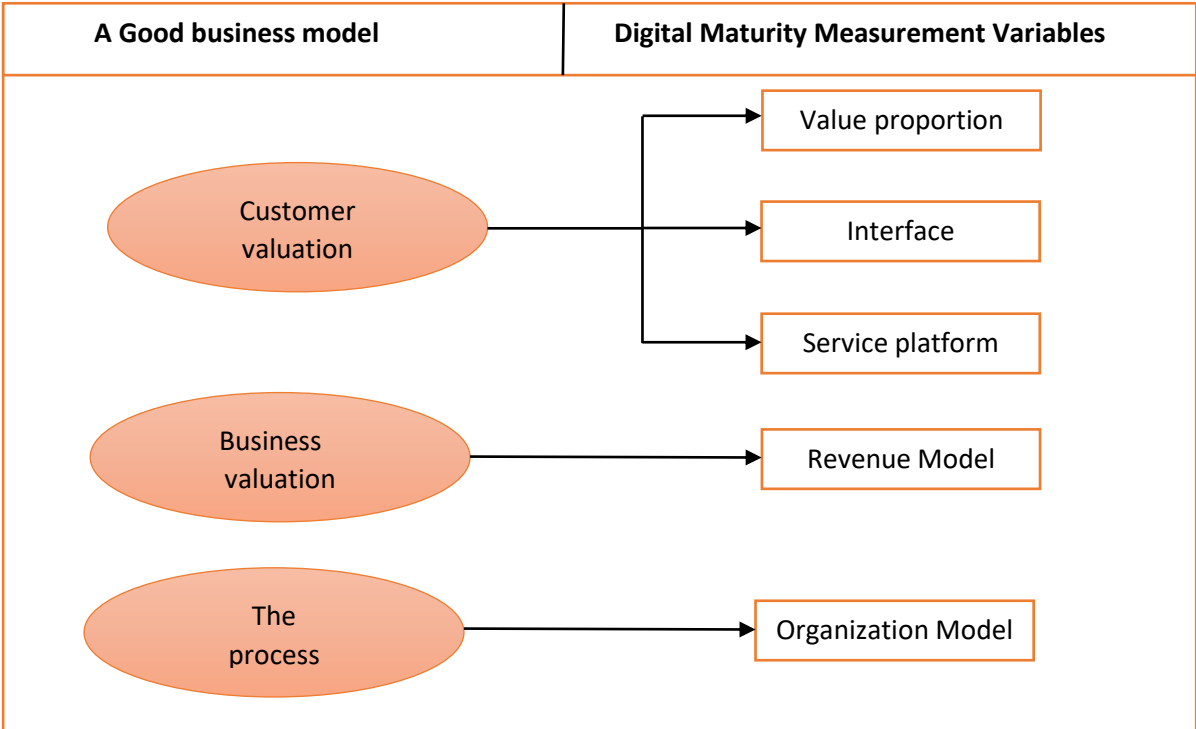
Schallmo et al. (2020), states that there is no matured model that meets the measurement criteria and each serves its own interest. This aligns with our findings where the 20 maturity models considered in this study (table 6) presented an independency. However, the models presented a commonality of what entails a matured business model. This commonality entails: the customer valuation, business valuation and process which relates to the discussion in RQ1.

Given that no defined measurement model exist for the measurement of digital maturity of liner shipping BMs, the study exploited the identified commonalities and proposed the VISOR framework discussed in section 2 and illustrated in table 1. The measurement model has 5 variables each with set of question that can be used to access the level of digital maturity of liners BMs as shown in table 4. The variables include: value proportion, interface, service platform, organization model and the revenue model. These variables can be used to measure the digital maturity of a good business model as illustrated in Table 8.

For customer valuation aim is to ensure we meet the need of the customers to their satisfaction. Measurement elements employed here are: value proportion, interface and service platform. The customer must present a will to pay a premium for product and services. Its assessment entails: the interface or the “wowing” experience, availability of a IT platform that facilitates delivery of services and products and the quality and level of value proportion. For the business valuation aim is ensure that the business model makes money which can be measured using the revenue model. The revenue model is characterized by the pricing methodology, potential volume and the partner revenue sharing. Lastly is the process, measured by the organization model. it can be accessed through: the quality of partnerships, availability of a digitally defined process and the pooling capability.

Concluding the response to RQ2, we propose that further research still need to be conducted using different research approaches in testing and verifying the applicability of our proposed measurement model.

Table 8: The digital maturity measurement variables of a good business model



Note: developed by Author

5.3 Mechanism

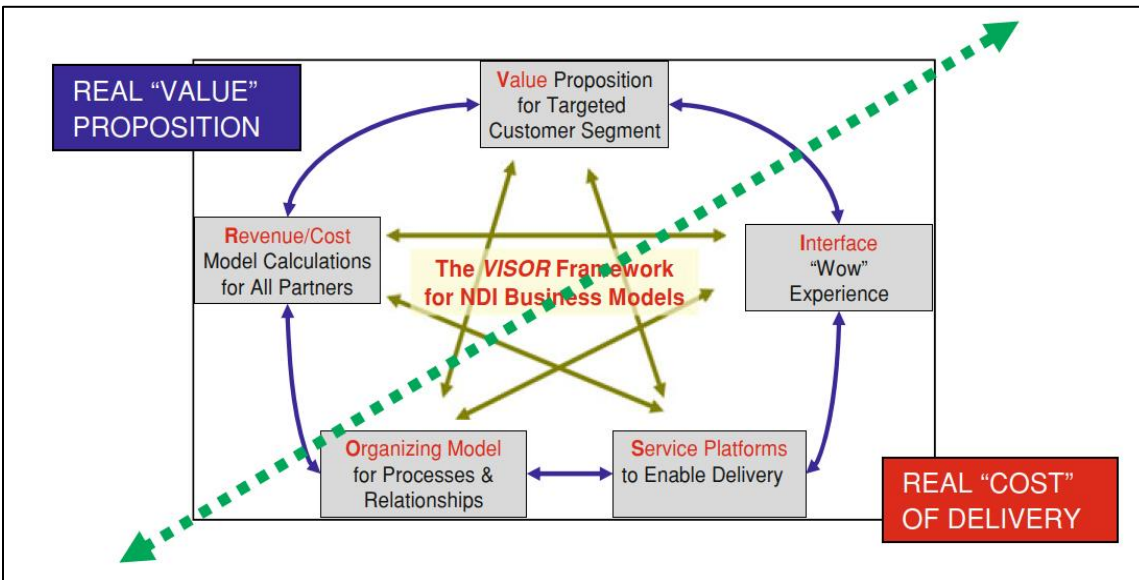
In this section, we look at the cognitive process in which the actors in this case the liner shipping companies choose to respond to the intervention or put the intervention into real practice. Responding to this is our third research question of the study:

RQ3: Which model is appropriate in measuring the digital business model maturity for the 21st century liner shipping?

From the literature review, no defined model could be termed appropriate for the liner shipping. However, it was observed from the 20 digital maturity models identified appropriate for this study, each of the model had been designed to measure the characterizing traits of specific sector. For example, Asdecker and Felch (2018) delivery process maturity model, focused on measuring maturity in ordering process, warehousing and shipping. The same was evident in Alankarage et al. (2022) Business Information maturity model where focus was on information and data, IT infrastructure, process and procedure the people and organization. What we learn from this is that a model can only be termed appropriate if and only if it has the ability to cover the traits characterizing its' given sector.

Thus, in respond to this question the study adopts this ideology and design an appropriate digital maturity measuring model for the liner shipping industry. The 21st century liner shipping industry has been characterized by stiff competition, uncertainties, regulation pressure, a looming business maturation stage, digitalization era and customer dominance. To survive in such environment, LSC have to adopt a business model that takes advantage of the presented challenges and create value from it. At the same time, they need a navigational tool that make them aware of where there are, where they need to improve on and where there want to be. With this regard we propose the adoption of the Unified VISOR measurement model as shown in figure 15.

Figure 15: The VISOR Measurement Model



Note: Adopted from El Sawy and Pereira (2013)

The choice of this model is based on the fact that the model integrates various approaches in business model development. It aligns with digitalization in emphasizing the need to recognize the two unaddressed yet very vital elements in the 21st century business. These elements are the customer and the money making process. The VISOR is able to align its respective components in a way that it delivers the greatest value proportion that can maximize the willingness to pay of its target clients and at same time minimizing the real cost in providing these services and in the process provide an optimal mix of wowing experience, service delivery platforms and organization model.

In addition to this, the model provides an assessment tool in which each of its five elements comes with a series of question as illustrated in table 4. A LSC can use the questions to determine its level of maturity, compare itself to its peers in the industry and also create an awareness on the areas it will be required to improve.

In concluding response to this question study emphasizes that LSC need to acquit themselves with the externalities presented in the business environment. This because the business environment keeps changing and models have to be readjusted accordingly to meet the change. The VISOR model presents such flexibility and can be adjusted to meet the given changes. On the same note to increase the breadth of assessment and full coverage LSC should also consider using other models alongside the VISOR. Example of such models could be: Ivančić., (2019), Urego and Reyes (2021), Rosemann (2019)

that focus on: the people – level of digital skill, migration layer - how a digitally matured a model is in adjusting to unprecedented business environmental changes and digital leadership skills.

5.4 Outcome

In this sub-section we evaluate the results of the interventions adopted by the liner shipping companies. To be discussed is the significance and deficiencies that comes with adoption of digital matured models. This forms our last question of study:

RQ4: What are the significances and deficiencies associated with adoption of digital matured business models?

5.4.1 Significance

The business environment of today is constantly subjecting organizations, into a never-ending competition pressures and uncertainties. The struggle befits, the strongest who by chance have embraced digital matured business model and are constantly using assessment models to keep pace with the fast changing business environment. Asdecker and Felch (2018), mentioned that, the DMM helps decision makers deal with the business pressure, enhancing of organizational excellency, and preparation of the future organizational and customer needs. Through these models organizations are able to assess their current status achieve their set end of state and benchmark themselves against the best practices in the business environment. Such conforms with Akdil et al. (2018), where they stated that, it's vital for an organization to be aware of when, why and where they should consider in moving forward.

5.4.2 Deficiencies

From our literature review we identified 85 maturity BMs that we narrowed down to 20. Some of articles we reviewed did factor more than 5 models in their study. Such a trend may seem positive indicating a growing interest in area but what is sweep under the carpet is that when these models are critically evaluated and analyzed we found out that the models are almost identical and are characterized by poor documentation. Our finding aligns with Garcia et al. (2012), in his claims that most of the models developed possesses limited documentation, lack a theoretical robustness, assessment and thus accepting such models could be a risky affair. Despite the growing campaigns of alliances aim been information sharing, we discovered that this information remained within the alliances, shipping lacks transparency as data can't be obtained at ease. This could explain the limited and unsatisfactory research in this subject area. There is a high probability that the models developed in literature will eventually befits into Garcia et al. (2012) claims.

CHAPTER SIX: CONCLUSIONS AND RECOMMENDATIONS

In this study, through a systematic literature review, an understanding of the concept of digital matured business models was provided. The study analyzed the existing digital maturity models in literature and how these models have been used as guidance tools by organizations in achievement of their set objectives both at company and business environment level. With regards to the shipping industry, the findings indicated a very limited research in this subject area. Only one articles out of the 23 relevant articles considered for study focused on shipping. For the liner shipping no article that was found.

Given the importance of digitalization and the pressure organization are facing from the digital era, we opted to contribute to this research gap by structuring the paper in measuring the digital maturity of liner shipping BMs. To ensure a holistic and reliable coverage of this, four research question were adopted as follows:

- RQ1: What is the status and characteristics of a good business model for the LSC in literature?
- RQ2; Which models are being applied by LSC in measuring their digital business model maturity?
- RQ3: Which model is the appropriate in measuring the digital business model maturity in the 21st century liner shipping?
- RQ4: What are the significances and deficiencies associated with the adoption of digital matured business models?

The study identified that a good model must be characterized by two major elements which are customer valuation and business valuation. An organization that embraces digitalization into these two major elements is able to achieve the winner status. A status that ensures high profitability, a happy customer and less competition.

Findings from literature never indicated a straight forward maturity model that LSC were using. To provide a probable way out, from the 20 maturity models identified, the paper aggregated their commonality and endorse them into the VISOR framework. The model can be used by LSC in accessing their level of maturity. The model comes with a set of questions which companies can analyze both qualitatively and qualitatively. The model was tested and validated on the top 20 liner shipping companies. The results indicated a lesser degree of maturity implying that LSC are yet to achieve the needed digital maturity level. At the same time further research is needed to develop the viability of this model.

DMBMs are of great significance to LSC not only do they act as guiding tools but also through them LSC can know: when, why and where they need to improve. Nevertheless, it remains to be a challenge coming to terms with the best suitable way of assessing the digital maturity of liner shipping BMs. A reason to this could be shipping itself is characterized by a lot of volatility and uncertainty. It just keeps changing.

However, it is in these volatilities and uncertainties that opportunities lie. LSC have best chances of getting the best leap if and only if they adopt digital technology, be aggressively innovative and stay ahead of the digital era. This seems to suggest the only way their customers and market demands.

The biggest challenge in the writing of this paper was a limitation on availability of information. By nature, shipping companies have always withheld their information with fear that access to it could give an advantage to their competitors. Thus not much information can be found from the online platforms. For future research we recommend that this study had adopted interviews or questionnaires from the practitioner in the LSC. Attempts were made but the number of responses at the piloting stage was limited as well as time required to complete this study.

For the future research directions, study should be focused on digital maturity in other shipping markets such as the tramp, factors that have an impact on the level of BMS maturity, and if there exist any connections between liner shipping business model maturity and their performance. Given that digitalization is here to stay and that it will keep penetrating into every aspect of life other than just liner shipping, it is highly recommended that study on the levels of maturity is continued. This could entail aspects of their key characteristics, way of improving its assimilation into business models and provision of scientific justification on its viability.

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