Port Business Development

Digitalisation of Port Authority and Hybrid Governance Model

Sequeira, Cheryl Basil

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SOLBJERG PLADS 3
DK-2000 FREDERIKSBERG
DANMARK

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PORT BUSINESS DEVELOPMENT – DIGITALISATION OF PORT AUTHROITY AND HYBRID GOVERNANCE MODEL

PhD Series 01.2023

Cheryl Basil Sequeira

PORT BUSINESS DEVELOPMENT

DIGITALISATION OF PORT AUTHROITY AND HYBRID GOVERNANCE MODEL

PhD School Department of Operations Management

PhD Series 01.2023

CBS COPENHAGEN BUSINESS SCHOOL
HANDELSHØJSKOLEN

PORT BUSINESS DEVELOPMENT:

DIGITALISATION OF PORT AUTHORITY AND HYBRID GOVERNANCE MODEL

PhD THESIS

CHERYL BASIL SEQUEIRA

Department of Operations Management

SUPERVISOR: GUNTER PROCKL

COPENHAGEN BUSINESS SCHOOL

Cheryl Basil Sequeira
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Dedicated to my grandmom, Philomena

Acknowledgement

Since I was three years old, I had two dreams, first is to have a PhD and second to work in Martime like my grandmom's family. As for my parents, they were both baffled by a three-year old's ambition. Happy to say that this three-year-old stuck to her dreams and got the opportunity to combine both a PhD and maritime together. This was not possible without all the special people that I met in my PhD journey of 10 years. In this section, I would like to say my heartfelt thank you to them. Be ready!

I would like to start by thanking my family, the bravest and kindest people I know. Thank you to my grandmom who at every school holiday, every summer holiday and every national holiday would cook warm food and tell us awesome (sometimes scary) fisherman stories of her brothers and father sailing in the Arabian sea at night. Thank you to my godfather Lawrence Lewis for always encouraging me to study and push Indian boundaries. Thank you to my godmother Flavia Lewis for showing me that an Indian girl doesn't need to fit in a box. Thank you to my Dad for being believing in me, my uncles Melwyn for taking me to all my exams and aunty Juliana for awesome food. Most importantly to my little brothers Denzil and Andy for being wonderful little brothers and sorry for being nagging older sisters.

Family is incomplete without the mention of Friends. Friends are the lighthouse that build a path to the shore. I would like to thank Vasuda Gregersen for laughing at my academic jokes and being there to see me off each time I moved to a new city. Thank you Mikkel Godt Gregersen for telling me how he sees it (This cupcake is finally done!). I would like to thank the most direct Dutch ever, Edwin for being my mentor, for all the free walks around Kralingse Plas and for the endless asking of 'How is your PhD writing going'? (which motivated me to finish my thesis as soon as possible). To my special friend Hanna Stelzel for showing me by example how to hold elegance, strength and compassion in the face of adversity. To Lise Lotte Andersen for driving all the way from Esbjerg to Rotterdam, so that I don't feel alone on my birthday. To Bitten Hollænder Bram for making me feel welcome in Esbjerg. You are one strong lady! .To Christine Just, for being my impromptu Danish translator.

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This PhD thesis has been one of my steady companions while moving to six different cities, saying goodbyes to friends, making new friends, starting new jobs, and settling in new adventures. It will be hard to say goodbye to it.

Thank you all for being there for me and making a three-year-old’s dream come true.

Best wishes,
Cheryl Basil Sequeira

Resume

The overall question addressed by this thesis was: 'How can port authorities develop their business through digitalisation in the current port reform landscape?' The thesis focuses on the concept of digitalisation to explore this dilemma, looking at three streams of research to identify an overall solution. The overall contribution of this thesis is to present a hybrid governance model that includes the concept of value in the new digitalisation port. To achieve a hybrid model, the three papers study each element of the governance model and present their contribution in terms of strategy, structure, and performance. This thesis (the three papers) has taken a theory building approach by synthesizing the existing literature and through the empirical data of three Nordic countries, contributed to three outcome streams. This thesis positions itself at a point where the port authorities in Nordic countries have started reforming themselves with the aim of transitioning to becoming corporate port authorities with business-like performance. The overall research question that this thesis examines is: 'What is 'value' for a newly digitally transformed port authority under a governance model?'

Resumé

Den overordnede problemstilling denne afhandling adresserer er: 'Hvordan kan havnemyndigheder udvikle deres virksomhed ved brug af digital teknologi i det aktuelle reformlandskab?'. Afhandlingen tager udgangspunkt i konceptet digitalisering, og fokuserer på tre specifikke forskningsretninger for at afstedkomme en overordnet løsning. Det primære resultat fra denne afhandling, er introduktionen af en hybrid ledelsesmodel der inddrager et værdibegreb i ledelsen af de nye digitale havne. Afhandlingens tre artikler undersøger hver især aspekter ved ledelsesmodellen, og præsenterer deres bidrag vedrørende strategi, struktur og performance. Afhandlingen opbygger sin teori på baggrund af eksisterende litteratur, og empiriske data fra tre nordiske lande. Forskningen er specielt relevant, idet havnemyndigheder i de nordiske lande har igangsat en reformproces, hvor formålet er at opnå mere virksomhedslignende strukturer med tilhørende performance. Det overordnede forskningsspørgsmål afhandlingen undersøger er: 'Hvad udgør værdi for en nyligt digitaliseret havnemyndighed under en ledelsesmodel?'

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1. WHAT IS A PORT? WHY IS IT IMPORTANT?

In simple terms, a port is place where ships, vessels, and cruise ships can perform the loading and unloading of goods and people. The word 'port' is also sometimes used interchangeably – and incorrectly – with 'harbour' or 'seaport'. The difference, however, is that a 'port' or 'seaport' refers to a place where you can make arrangement to moor your vessel, transfer passengers, and trade goods from your city. Ports were historically – and still are – considered one of the primary sources of a country's economy. Similarly, ports – symbols of trade and transport – are also commonly viewed by politicians as a representation of the degree of internationalisation of a country's trade. They are key factors which can boost the economy and enhance regional efficiency, and indeed even engender significant environmental or social change. This raises the question as to whether all development is the same, or whether some ports develop more effectively than others. The current research in this field has begun to see ports as businesses rather than just another means of connecting ships to the land and the city. Ports have evolved far beyond this original definition and description. This thesis takes us through the evolution of port research, with the context adopted here encompassing the harbour, the authority, and the infrastructure. Although the term 'ports' is also commonly used to describe 'airports', this paper focuses only on the maritime port function.

2.NORDIC PORTS OF EUROPE

There are 38 Ports in Denmark that still receive port call request form the ships. Compared to Denmark, Finland consists of approx. 65 ports and Sweden consist of approx. 95 ports respectively. For this study, the thesis studies 8 ports that show the similar characteristics and provide services to similar size of ships. In the Figure (1) below, we describe the ports that are investigated in this thesis along with their ownership status and the year they were reformed.

Port Authority	Country	Ownership	Reformed Status	Size	Port Call [1]
Port of Køge	Denmark	MSG	2000	S	912
Port of Esbjerg	Denmark	MSG	2000	M	17916
Port of Aarhus	Denmark	MSG	2000	M	5288
Port of Associated Danish Port (ADP)	Denmark	MOLG	2016	M	5953
Port of Aalborg	Denmark	MSG	2000	M	807
Port of Odense	Denmark	MOLG	2017	M	764

[1] Port call in 2020

Port of Kvarken	Sweden	LTD	2015	S	650
Port of Haminakotka	Finland	LTD	2012	M	2700

Figure 1: Nordic Port Table

3. DANISH PORT LAW: LEGAL AND JURADICATION

In 1999, the Commercial port law was abolished and replaced by a new law of Danish Port law, 1999. The rules and provisions of this law is decided by the Ministry of Transportation, they translate the international rule, present directives, and implement the EU regulation in the port law. The Danish port law stated a clear boundary on the port authorities legal judicial role. In chapter 4, section 6, the Danish port law delineated that the port authority can be organized under five different types of governance (See Table 1). These are a state port, a municipal port, a municipal self-governing port, a wholly or partly municipally owned limited company or a port organized under private law (Havnelovudvalget, 2011). In respect of state port, is managed by the Minister of Transport and the ports can offers basic berth facilities and can provide land to build cranes and warehouse. The municipal port has the same boundaries but is governed by municipal. The municipal self-governed ports, have the opportunity to hire expert management to develop strategies and maintain port business (Port of Aarhus, Port of Esbjerg, Port of Frederikshavn, Port of Kalundborg, Port ok Koge, Port of Odense and port of Vejle). In this type of ports governance, Danish ports can create new business if there is no private actor to perform the duty. There are few Danish port authorities that are wholly or partly municipally owned limited company is a commercial enterprise, can provide cranes, warehouses and can merge with other port authorities to carry out an operation (Association Danish Port, Copenhagen Malmo Port, Port of Grenaa, and Port of Odense). There is no private port in Denmark as of 2022.

Under the Statutory Order on Standard Regulations for the Observance of Good Order in Danish Commercial Port, the port authorities are responsible for providing berth to vessel when notified under 24 hours (under section 1(2) of *Notification* and section 3(3) of *Berth*). The section 1 (2) stated that port authorities can receive the ship data, expect time of arrival, and expect time of stay and the purpose of the ship call. The port authority is highly depended on the agents for this information and this activity tends to have lost of error and miscommunication. Under section 1(1-6) The port authorities are also legal eligible to receive information about the goods type and the expected waste disposal request of the ship.

The Danish port law doesn't state that the municipal self-governed ports and the wholly or partly municipally owned limited company are entitled to receive information that assist them in providing crane as a service. The information expected time of crane usage, draft needed for the vessel and the cargo type (non-dangerous) are not considered under the section 1 (2) of notification.

Table 1: Adopted form Merkel & Slok-Madesn (2019)

LEGAL FRAMEWORK	MSG	MOLC
Maintain and operate infrastructure (e.g. berth and Basins)	Yes	Yes
Land rentals for companies	Yes	Yes
Cooperative agreements with other ports	Yes	Yes
Provide crane and warehouse to ships and stevedores	Yes	Yes
Perform port related operation	Yes	Yes
Perform ship related services	Yes	Yes
Use excess capacity to sell services	Yes	Yes
Own and operate buildings and facilities that serve the port	Yes	Yes
Own and operate hydro power and wind power plant	Yes	Yes
Provide other service intended to support port user		Yes
Invest 15 % of the company equity in foreign ports		Yes
Must Cover Costs	Yes	
Keep up-to date with administration for the port (separately for the municipality)	Yes	Yes
Must account funds separately from those of the municipality	Yes	Yes

4.EMPIRICAL PROBLEM

Denmark is a Nordic country situated in the northern part of Europe. At present, 38 ports are situated in Danish harbours, with the majority of them being small to medium-sized, and viewed as somehow capturing the identity of the city in which they are found. Most of the ports freight traffic flows from Germany, Sweden and Norway. In 2020, the total freight turnover was 64,822 thousand tons (Danske Havne). The biggest port in Denmark in terms of freight turnover is Copenhagen Malmø Port Ab (CMP) with 13,900, followed by Aarhus Harbour with 8,895, and then Associated Danish Port A/S (ADP) with 6,323.
The largest amount of port call by ferry and freight call in 2020 were Elsinore Harbour (22,254), the Port of Esbjerg (17,916) and the Port of Aarhus (5288). The Danish port authorities were reconfigured in 1999 in order to increase competition between ports. In total, six ports decided to become public limited liability ports, with 22 deciding to change their ownership to municipal self-governed ports. This empowered management to try and attract new business by investing in super structure infrastructure, investing into new employees, and by opening their ports to new ideas. These changes in management were the catalyst for Danish ports to pursue their interests in digital innovations. Danish port authorities are built on a foundation of old traditions and manual way of working. One of the main hurdles for Danish port management was how to transition their

organisation, and how their colleagues could work with them in trying to achieve digitalisation. The initial problem was that since the 1999 port reform, 22 Danish port authorities have adopted municipal self-governance, and begun investing in commercial and marketing efforts to attract more business to their ports, which historically would have been the responsibility of other market parties (such as freight forwarders). This change created mistrust and decreased the collaboration between port authorities and their communities, creating a barrier for Danish port management as it tried to develop its digital practices.
The majority of ports in Denmark are small and medium-sized, with most situated in smaller cities. Their survival depends on attracting more businesses to rent and generate cargo volume flow. As such, they need to be more entrepreneurial in their strategies, and being publicly funded gave them the opportunity to invest in new digital technologies and to optimise their own business processes, meaning that they could become smart ports. One obstacle in this process was that per Danish port law, their legally allowed function and responsibilities were predominantly operationally-related services (i.e. providing infrastructure, entering into cooperative agreements with other ports, and providing crane, warehousing services and ship-related services) whereas digitally-related services (i.e. port call optimisation, data sharing plans and efficiency related platforms) were overlooked, with 'day to day administration' being the only mention of this.
This contributed to the second problem faced by port management, namely that they had the zeal to recognise the potential of digitalisation, but they lacked the regulatory guidance or information about the scope of digitalisation, for example data sharing, digital platform services and the digital optimisation of the port call procedure. This paper argues that for Danish ports to survive and thrive, it is imperative that there should be a well-defined thesis regarding digitalisation in this context. This needs to answer the question as to what the port authorities' new responsibilities are in a digitalised world, what capabilities they need to transition into a digital smart port, and whether investment and transition towards digitalisation is valuable. Of most importance is the question of what additional directives should be made to Danish port law in order to predict and support the digital transformation of the Danish port authorities. Moreover, how can trust, transparency and the monitoring of digital transformation be transitioned into Danish port law so that there is an increase in collaboration on digital projects and in the digital exchange of data between the port authorities and the Danish port community. Together, it seems that the Danish Port Association, the Danish Ship Broker Association and the Danish Freight Forwarding Association could play a huge role in navigating Danish port governance towards a positive and trusting digitalisation transformation.

One silver lining is that in 2018 a committee of experts presented their first proposal for a new Danish port law. This is currently under review, requiring more political negotiation and rearrangement. The remit of the Danish Port Association is to create a law that will be applicable for years to come, and will give the port authorities the chance to thrive in the European market. As stated by the Danish port association (Danske Havne, 2018) below:

'Vi ønsker i øvrigt en havnelov, der sigter mindst ti år frem i tiden, så den kan give mulighed for nye samarbejdsformer mellem offentlige og private aktører, og så hver især kan bidrage med det, de gør bedst. Kun sådan kan vi med forholdsvis små havne klare os i europæisk sammenhæng'.

"We want a port law that looks at least ten years in the future, so that it can allow for new forms of cooperation between public and private actors, so that each can contribute what they do best. Only in this way, with relatively small ports, can we cope in a European context."

This thesis understands that to invest in digital transformation, the Danish port authorities have to convince both internal and external stakeholders to invest, collaborate and trust each other. Along the same lines, there should be enough value in digitalisation for the whole Danish Maritime community to justify the public finding they would receive. It is also understood that there has to be a clear understanding about how digitalisation develops port authority business without compromising their legal role as defined in Danish port law. Finally, the concern that there would be some changes in the port authority organisation due to the digitalisation investment is well understood. Previously, the best way to work around these inefficiencies was to hire more employees; however, given the relatively small size of Danish ports, there is not always a sound justification to hire. Therefore, one alternative to this is to digitalise the business processes. This would not only provide efficiency in performance but would also provide less administrative burden to the port community.

5. LITERATURE REVIEW

5.1. PORT BUSINESS DEVELOPMENT LIERATURE

The literature review in this paper is restricted to port literature, which aspires to make contributions to the economy by being competitive in the international shipping industry. This thesis argues that our intention is reflected by the following quotation by Heaver (2006: 11), that "the evolution of the study of shipping and ports reflects the history of the maritime industry." The literature review will be limited to international shipping and seaport industries. Port literature was first published in the 1950s, and focused on economic analysis, politics, crime, sociology, safety, management, strategy, and operations (Goss, 1986; Trevor Heaver, 2006; Metaxas, 1983). This era also saw the development of a theoretical framework (Goss, 1986) which was later used to provide a theoretical foundation to port literature. The 1970s introduced the containerisation of cargo transport and reorganised the landscape of port infrastructure investment. The era also saw published research that focused on cost-based research strategies which optimised cargo containerisation. Most of the research focused on the optimisation of the container journey, for instance optimising the operation of containers in port terminals , ship routes for fast navigation of the container (ibid.), and the geographical location of the port so that container vessels had rapid access.

The current literature continues to replicate these topics in their research objectives. The port literature of the 1980s and 1990s highlighted how port actors developed their roles, and examined the methodologies used which analysed these roles with regards to the activities they undertook in ports (Jansson & Shneerson, 1982). This said, this topic was still under-researched, albeit not for too long. In the 2000s, the port literature developed in maturity, and started to be divided into streams of themes that required a multidisciplinary perspective (Woo, Pettit, & Beresford, 2011). The port literature showed awareness about port authorities, invested in the acquisition of new skills to optimise their decision marking, went beyond their defined scope of responsibilities, and gained expert knowledge(L. V. der Lugt et al., 2015).

Since the 2010s[2], the port literature has followed a pattern of multidisciplinary research (Akyuz & Erkan, 2010; K Bichou & Gray, 2005; Brooks et al., 2011; Chang & Talley, 2019; Pallis et al., 2010; Panayides & Cullinane, 2002; Parola et al., 2017; Rong et al., 2010; Sarkis et al., 2011; Sdoukopoulos & Boile, 2020; Verhoeven, 2010; Woo, Pettit, Kwak, et al., 2011) The port literature demonstrated maturity in its theoretical framework implementation, as argued by Wang and Mileski (2018: 299). It spread into areas such as strategic management, organisation studies, and logistics and supply chain management (Panayides & Song, 2013; Wang & Mileski, 2018)This was also the time when the port literature emanating from some researchers (L. V. der Lugt et al., 2015; D.-W. Song, 2010; Verhoeven, 2010; Zhang et al., 2018a) added a more corporate perspective to their decision making process. Port literature at this time also saw the introduction of the term 'business-like', which is investigated further in our three papers[3]. Along similar lines, port governance research was studied under the lens of the environmental matching framework (Brooks & Cullinane, 2006b; Brooks & Pallis, 2008).

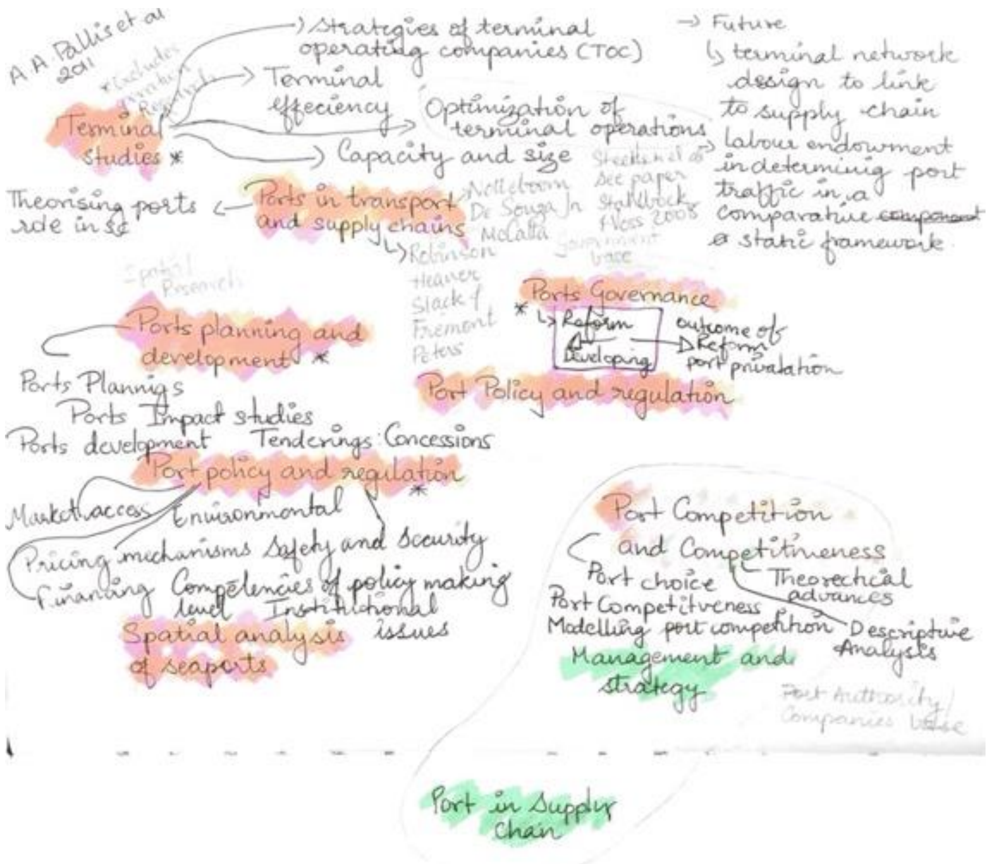


Figure 2: Snapshot of the Candidates 'Field and Memo book'

[2] See Figure (1): Snapshot of the Candidates 'Field and Memo book'
[3] See Section (6.2) of Paper one. This section explains the framework for recognising 'business-like' opportunities.

This framework evolved, was challenged, and was subsequently redefined under the stream of port governance (Baltazar & Brooks, 2006; Brooks et al., 2017; Brooks & Pallis, 2008; Lee & Lam, 2016; Pallis & Syriopoulos, 2007; Zhang et al., 2018b). The port governance literature also includes 'specific port authority case studies' taken from the perspective of policies, institutions, and reforms (Debrie et al., 2017; Everett, 2007; P. W. D. Langen & Lugt, 2017a; Merkel & Sløk-Madsen, 2019a). This port literature development has contributed continuously to the maturity level of the port authority research in the context of supply chains and logistical chain(Panayides & Song, 2013; D.-W. Song & Panayides, 2008).

The port authority literature is split into three different streams of study, namely: the role of the port authority in logistical management (T. Notteboom et al., 2018; Ritala et al., 2014; D.-W. Song, 2002; D.-W. Song et al., 2015; Wilhelm, 2011); port authority strategy (Cariou et al., 2015; Hong et al., 2009; L. V. der Lugt et al., 2015; L. M. van der Lugt et al., 2017; Parola et al., 2013; Tsiulin & Reinau, 2021); and port authority contribution to performance in the supply chain(Khalid Bichou, 2006; Khalid Bichou & Gray, 2004; Bray et al., 2015; Brooks & Schellinck, 2014; Marlow & Casaca, 2003; Rozar et al., 2022; Schellinck & Brooks, 2014; Talley et al., 2014; George K Vaggelas, 2019).This does not mean that the streams do not overlap with each other. Port authority strategy studies have been investigated in coopetition ports to create competitiveness in logistics (Robinson, 2017; D.-W. Song et al., 2015; Zheng & Luo, 2021), as has port authority strategy and its implications for port performance or supply chain performance (Khalid Bichou & Gray, 2004; Brooks & Pallis, 2013; D, 2017; P. W. D. Langen & Heij, 2014; George K Vaggelas, 2019; Woo, Pettit, & Beresford, 2011).This thesis aspires to replicate this process, studying port authority strategy within the context of performance, strategy, and structure (Brooks & Cullinane, 2006b).

As noted earlier, a matching framework evolved, was challenged, and was subsequently redefined under the stream of port governance (Baltazar & Brooks, 2006; Brooks et al., 2017; Brooks & Pallis, 2008; Lee & Lam, 2016; Pallis & Syriopoulos, 2007; Zhang et al., 2018b). There is a theoretical possibility that this stream can be studied through the lens of another mature stream of literature. The thesis recognises, following the development of port literature as described above, that the next development will be cross-disciplinary. This has already been seen in the strategic literature, where cognitive aspects were studied within the port authority strategy context (L. M. van der Lugt et al., 2017). Moreover, there has been growing interest in theorising strategies from the corporate perspective of coopetition (D.-P. Song et al., 2016; D.-W. Song, 2010; D.-W. Song & Lee, 2017), which can develop far beyond the theoretical framework of entrepreneurship. Furthermore, the evolutions of these strategies contribute to new challenges at the organisational network level (Ducruet, Lee, et al., 2010; Harrison & Håkansson, 2006; Hoshino, 2010; Lam & Yap, 2011b; Martino et al., 2010; Rong et al., 2010) which move beyond infrastructure to the technological development of the supply chain network (Tsiulin & Reinau, 2021). This literature stream, however, is slow to develop, and lacks a framework due to the constraints of port governance within port authorities. This thesis acknowledges that there is a need to further understand the environment fit of the current port governance framework. This thesis studies the merging of the concept of digitalisation from the perspective of creating more port competitiveness to the supply chain. The intention of this researcher is to further refine the environment fit of port governance.

As the world has digitalised, ports have struggled to understand their role in the supply chain. The port is a traditional industry, in which port users are proud of their manpower and where the daily processes and functions are known to everyone – but never written down – and solutions are identified reactively (Tsiulin & Reinau, 2021). As such, not all port users see the need for port development, especially in a context of digitalisation that is infamously misconceived as wanting to replace the workforce. Since the reform of Danish ports in 1999, the ambition of the Danish Port Authorities has shifted from being a landlord port authority (L. V. der Lugt et al., 2015; Verhoeven, 2010)to a service-oriented infrastructure provider (Merkel & Sløk-Madsen, 2019b). There has been major reconfiguration of C-level management, with more commercially and business-minded employees being appointed to executive boards. This has given rise to concerns as there has already been digitalisation investment undertaken in some Danish port authorities, which has made it crucial to justify the value which digitalisation holds, not only for the port but also the whole port community(Tsiulin & Reinau, 2021).

When considering the fact that all these users have the same aspiration when digitalising their processes, which is to be more efficient, it is crucial that ports as service providers, commercial ports, and port authorities, all need a clear definition of their own role in order to avoid supply chain disruption. As explained in the literature review section (3), port authorities have a well-defined judicial role that maps the boundaries of port call and vessel inspection for the vessel which has called the port (Merkel & Sløk-Madsen, 2019b). As a service provider or an infrastructure provider, the port has a broader role (Acciaro et al., 2014; Berg et al., 2012; Tijan et al., 2021; Tsiulin & Reinau, 2021), which gives the port more opportunity to digitalise their processes. This highlights the need to conceptualise and evaluate how digitalisation can contribute to the port authority's processes in terms of port efficiency and port performance. Despite this, no conceptualised model has yet been implemented, and there has been no testing of any post-digitalisation processes which show how value has been created for the port authority.

5.2. PORT COMPETITIVENESS

Port competitiveness is the offering provided by a port authority to its community which can be translated into a specific route, cost incentive, geographical location, connection to other ports, or inland connections (Cui & Notteboom, 2018; T Heaver et al., 2001; Hoshino, 2010; Lam & Yap, 2011a; Martino & Morvillo, 2008b; Robinson, 2017; Trujillo et al., 2018; Yap & Lam, 2006). Some competitiveness, however, is not created by the port, but rather by another actor that has been either consciously developed by the port or else bought by the port authority to differentiate themselves (Balen et al., 2014; Dooms et al., 2013; Haezendonck et al., 2006). Along similar lines, the value of the port is not solely dependent on the port authority, but also on its community. This would include the competences provided by the terminals or stevedores situated at the port or the possibility of participating or collaborating in new initiatives (Khalid Bichou & Gray, 2004; P. W. de Langen, 2020; T. E. Notteboom & Winkelmans, 2001a, 2001b; Robinson, 2017). Another factor that contributes to port competitiveness is the density of the network's connectivity (Khalid Bichou & Gray, 2004; P. W. de Langen, 2020; T. E. Notteboom & Winkelmans, 2001a, 2001b; Robinson, 2017). A well-connected port is highly coveted by both shipping lines and freight forwarders.

Achieving network density depends on the collaborative initiatives between the port authority and the port actors, or with customer profiles situated in the port vicinity or already visiting the port for different operations (Cahoon et al., 2013; Ducruet, Rozenblat, et al., 2010; Harrison & Håkansson, 2006; Hollen et al., 2014; Hoshino, 2010; L. van der Lugt et al., 2013; Ma et al., 2021; Martino et al., 2010). In addition, port competitiveness also depends on the flexibility of the role which the port is prepared to perform (Cullinane et al., 2005; Yeo & Song, 2006). However, there exists no measurement or framework which can be applied to contribute to the port's competitiveness. This is where the challenge lies in port competitiveness literature. In the port authority literature, port competitiveness needs to consider both the internal development of the company as well as external relationships with the inter-organisational network(Das & Teng, 2000). Furthermore, the role of international associations and EU policies also contributes to port competitiveness. Port governance plays a key role in challenging the aspiration of port authorities by regulating legislation that limits the jurisdictional role of the port authority (Merkel & Sløk-Madsen, 2019a). As such, this profoundly affects port competitiveness.

In addition to the port inter-organisational network, port portfolio also plays a role in defining its competitiveness. This includes the depth of the water for deep sea vessels, access to the hinterland, port dues, vessel waiting times, berthing priority, distance between ports (Adenso-Díaz et al., 2020; Guo et al., 2018; Malchow & Kanafani, 2004; Wiegmans et al., 2008)Taking this into consideration, researchers have also included innovative developments to make their port more attractive to port users, such as implementing digital technology(Martino & Morvillo, 2008a), investing in superstructures or new cranes to handle project cargo, or updating their security protocols to ensure faster customs clearance (Khalid Bichou & Gray, 2004).

In line with our comments above, this thesis focuses on merging different streams of research, mainly focusing on the development of multidisciplinary research. Taking out departure from port inter-organisational networks (Harrison & Håkansson, 2006)and innovation development (Martino et al., 2013, 2015; Martino & Morvillo, 2008b; Tsiulin & Reinau, 2021), this thesis merges the two to investigate the role of digital innovation in increasing port competitiveness. This also follows the port governance stream in studying the impact it has on these digital innovation initiatives (Tijan et al., 2021).

5.3. PORT GOVERNANCE

Port governance is the key to the strategic success of port authorities. It became popularised during the 1990s, capturing the attention of academia, policy makers, lobbyists and port authorities (Zhang et al., 2019). The term 'port governance' can define either the governance of a port or the governance of a port authority (Verhoeven & Vanoutrive, 2012). This paper argues that the term 'port governance' can further explain the stakeholder management of the port's economic, social and policy actors. The term 'port authority governance' describes the 'corporate governance' of the port authority, i.e. what they can and cannot do in terms of economic development (Brooks et al., 2017; Brooks & Cullinane, 2006a; P. W. D. Langen & Lugt, 2006; Verhoeven & Vanoutrive, 2012; Zhang et al., 2018a). Furthermore, the term 'port authority governance' has a legal and jurisdictional implication which is generically applied to the cluster of port authorities situated in a country.

Several researchers have examined the port governance literature through from the perspective of devolution (Baltazar & Brooks, 2006; Brooks, 2006; Debrie et al., 2007), management governance (Pallis, 2006a; Pallis & Syriopoulos, 2007; Verhoeven & Vanoutrive, 2012), operational profile (Hoshino, 2010; Verhoeven & Vanoutrive, 2012), functional autonomy, investment responsibility(Merkel & Sløk-Madsen, 2019a), and financial autonomy (Verhoeven & Vanoutrive, 2012). However, these perspectives are not fixed. Port governance is often overlooked in the context of entrepreneurship or environmental initiatives or digital administrative transparency. The literature agrees that governance practices are open to realisation, although it may take time for these changes to be implemented in the system. Often the evolution of port governance is slowed in order to maintain the bargaining power of the shipping lines and other port actors (Hall & Olivier, 2007; T Heaver et al., 2000; Jacobs & Hall, 2007; Slack & Frémont, 2005; Vanelslander, 2015; Verhoeven & Vanoutrive, 2012).

Most of the port governance research is limited to case studies and are not, to a large extent, quantifiable (Pallis et al., 2010; Verhoeven, 2010; Zhang et al., 2019). It can therefore be concluded that port governance is a complicated tool (Zhang et al., 2019) One of the governance tools is price mentoring, where port authorities have to make their port tariff publicly available. Another is monitoring port governance, where port authorities have to be notified 24 hours prior to the vessel calls and the port authority has to be able to provide a berth for this vessel. Yet another is environmental port governance, where the port authority has to make an environmental impact assessment before investing in building mega infrastructure. In addition to these tools is the new stream of port governance which also includes coopetition port governance (D.-W. Song et al., 2015) and information technology port governance of Single Window (Tijan et al., 2021).

Taking our departure from Baltazar and Brooks (2006), Brooks et al. (2017b), and Brooks and Pallis, (2008), this thesis studies the port governance model as a framework at a port authority and legislative level (Baltazar & Brooks, 2006; Brooks et al., 2017; Brooks & Pallis, 2008). Its intention is to contribute from the strategic perspective of coopetition, the managerial perspective of digital resource sharing, and the inter-organisational perspective of network density.

5.4. INTERORGANIZATIONAL NETWORK EMBEDDEDNESS

In this thesis, interorganizational network embeddedness is defined as companies' relationships with their network based on their needs (Granovetter, 1985). The connectedness of the relationships refers to business, trust-based or contract-based relationships that assist a company in gaining access to valuable resources (Chandra et al., 2009; Håkansson & Snehota, 1989; Håkansson & Waluszewski, 2013; Ritter et al., 2004). It can be argued that interorganizational embeddedness can provide *accessibility to scarce resources* that can increase a company's competitiveness. The relationships between port authority, port actors, port policymakers and port community can provide better access to resources, which is not attainable with individual agreements (e.g., between terminal and port authority) or interactions (e.g., between agent and port authorities) (Ratajczak-Mrozek, 2017a).

One of the major scarce resources for a port authority is access to information. Information can be defined here as knowledge about the market, the logistics of a vessel and business opportunities. For the interorganizational network, access to information can result in building new relationships that can provide solutions to the port as a whole (Harrison & Håkansson, 2006; Martino et al., 2010). This can enhance the port's attractiveness and competitiveness. In interorganizational network embeddedness, relationships or interactions create two kinds of opportunities: market-related ones and technology-related ones (Ratajczak-Mrozek, 2017b).

According to Ratajczak-Mrozek (2017), a low degree of embeddedness leads to market opportunities whereas a high degree of embeddedness favours technological embeddedness (Andersson et al., 2005, 2015; Ratajczak-Mrozek, 2017a). To obtain technological advancement, we need a higher degree of embeddedness in the port community. This can be made possible by interorganizational relationships based on trust, mutual agreements, contracts temporary collaboration and cooperation. Implementing these measures will also contribute to the ultimate goal of improving performance, productivity and effectiveness in the port community. Therefore, to recognize technological or market opportunities, it is essential to acquire experiences that assist us in building embedded relationships and interactions with the port communit

5.5. ENTREPRENEURIAL OPPORTUNITY RECOGNITION IN INTERORGANIZATIONAL NETWORKS

Many views have been expressed regarding entrepreneurial opportunity recognition. To build a link between port governance and entrepreneurship, it is necessary to understand Schumpeter (1934), Hayek (1945) and Kirzner (1973), whose views reveal different aspects of entrepreneurial opportunity (Hayek, 1945; Kirzner, 1973; Schumpeter & Nichol, 1934). Although his theory evolved over time, Schumpeter's (1934) central idea remained that of the 'creative destruction' process – a process which occurs when new opportunities displace existing business models. On his part, Kirzner (1973) explored the process of discovering opportunity, which ends with an assessment of risk and uncertainty. Shane and Venkataraman (2000: p 218) offer a more extensive definition, saying that the "field of entrepreneurship [is] the scholarly examination of how, by whom, and with what effects opportunities to create future goods and services are discovered, evaluated, and exploited" (see also Hitt et al., 2001). Similarly, opportunity in the interorganizational network is defined as the possibility of finding a new idea that contributes to new business (Dyer & Singh, 1998; Hitt et al., 2001). However, we do not always need to find exciting new ideas; opportunity can also mean developing and sustaining the current business.

In a similar vein, the entrepreneurial recognition of opportunity has been investigated by many scholars of organizational relationships (Bhagavatula et al., 2010; Foss et al., 2015; Keh et al., 2002). In recent years, the topic has also gained attention in multidisciplinary works. (L. M. van der Lugt et al., 2017), for example, examined one of the cognitive antecedents of opportunity recognition in port authority strategy. To examine the phenomenon further, the antecedents that determine opportunity recognition should be identified (Shane & Venkataraman, 2000).

The first antecedent is entrepreneurial alertness, which is achieved by a company or individual that evaluates interactions and connections and has the ability to judge an idea (Tang et al., 2021) The second antecedent is prior knowledge, that is, expertise and insights gained by a company or individual over time (Arentz et al., 2012)). This knowledge can be divided into industry knowledge and expertise knowledge (Bliemel, 2010). The former encompasses market knowledge, business knowledge and customer knowledge (Scott Shane, 2000). Prior knowledge can provide port authorities with the means to build relations, collaborations and coopetition with the interorganizational network. From a resource-sharing perspective, prior knowledge can provide insight into the central actors that control scarce resources. The third antecedent is network ties, or networking, which involves proactive communication and interaction with the network to influence new ideas inside it (García et al., 2021; Saz-Salazar & García-Menéndez, 2015). These network ties can be both formal and informal (Kontinen & Ojala, 2011).
However, the key to opportunity recognition is to respond proactively to change and take risks in a self-conscious manner (Ardichvili & Cardozo, 2000; Ardichvili et al., 2003). The above antecedents can provide an edge to companies that are controlled by legalisation and fixed governance. The antecedent of entrepreneurial alertness can result in new customers in an overlooked market segment (L. V. der Lugt et al., 2015). The antecedent of prior knowledge can provide insights into investments to be undertaken and technological upgrades to be implemented for an organization to be competitive(L. M. van der Lugt et al., 2017). Moreover, the antecedent of network ties increases the coopetition in strategies and cultivates the added value of competitiveness (Harrison & Håkansson, 2006; Hoshino, 2010; T. Notteboom & Rodrigue, 2008). The possibilities created by these antecedents can highlight a new form of entrepreneurial opportunity that can be undertaken in a port authority governed by legislation. Furthermore, entrepreneurial opportunity recognition adds value to coopetition for ports that are venturing into the port community for alliance and cooperation to increase their competitiveness.

6. THEORETICAL PROBLEM

This thesis aims to solve the empirical problem of how port authorities can develop their business in their current port governance. Although this question has been asked before by a range of scholars (P. W. D. Langen & Heij, 2014; P. W. D. Langen & Lugt, 2017b; Pallis, 2006a, 2006b; Georgios K Vaggelas & Pallis, 2010), these contributions have not been analysed from the perspective of the multidisciplinary literature of entrepreneurship. As such, this question could be modified to 'how port authorities can develop entrepreneurial business in their current port governance?', but the theoretical foundation of the governance model does not provide enough support to enquire further into this phenomenon (Zhang et al., 2019)

Given this, this section challenges the limitations of the port governance model in terms of both its applicability to Danish port governance and its adaptability in the entrepreneurial alertness subsection of the entrepreneurial behaviour literature (Gaglio & Katz, 2001; Scott Shane, 2000; Scott Shane et al., 1995; Scott Shane & Eckhardt, 2005; SCOTT Shane & Venkataraman, 2000; Scott Shane & Venkataraman, 2001) as well as network centrality as a subset of the structural embeddedness literature (Bliemel, 2010; Granovetter, 1992; Polidoro et al., 2011).This paper limits its contribution to the governance model of Brooks and Pallis (2008) as opposed to Balthazar and Brooks (2006). The reason that the latter model only addresses the reconstruction of the environment, structure and strategy whereas the former goes one step further in the formation and execution of port governance in the context of port performance. This approach is a better fit down the line for the three papers as it also proposes stages of implementation for port performance, which is not discussed at all in Brooks and Balthazar (2006).

Being the most adopted governance model, explaining as it does the concept of port governance as a process, this thesis hopes to initiate a dialogue about adaptability into other streams of literature that focus on market process through entrepreneurial alertness to opportunity ((1963, 2007; Kirzner, 1973, 2009) and the embeddedness of those entrepreneurial opportunities (Dubini and Aldrich, 1991; Jack and Anderson, 2002; Elfring and Hulsink, 2003; Chandra *et al.*, 2009; Andersen, 2013; Andersson and Evers, 2015; Hilmersson and Papaioannou, 2015; Ratajczak-Mrozek, 2017). This thesis follows the governance model of Brooks and Pallis (2008)which has a wider scope than its predecessors who made initial contributions to the governance model (Baltazar & Brooks, 2006). Most of the governance model literature focuses on the processes and devolution of port governance rather than understanding the underlying implications and externalities that influenced these devolutionary changes.

Emerging from this, a simple question is asked in this thesis, which is how the view of entrepreneurial alertness expressed in Kirzner (1973) contributes to the strategy element of the port governance model. Similarly, this thesis aims to create a stronger network centrality (embeddedness) between port authorities and port actors in order to recognise the opportunity that contributes to efficient port performance. In a similar vein, port governance does provide an element of structure that contributes to the performance effectiveness and efficiency literature (Oliveira et al., 2021). However, it does not provide insights into meticulous network relationships which, when important resources optimally and continuously flow, mean that efficiency is reached in port performance, eventually contributing to a stronger network centrality in the governance model.

In addition to the governance model, a further aspect which is incorporated is (Cullinane et al., 2002; Cullinane & Song, 2001) (2002) 'devolution', which explains the shift of responsibility from an authority to the private sector. This occurs either through a shared responsibility system or a concession or sale of the respective operation. As such, this thesis takes devolution rather than privatisation into consideration when studying port authority governance due to the broader scope presented by this perspective and the fact that it may be able to make a contribution in terms of reliability, generalisation, and relevance. This thesis limits it scope to self-governed municipal ports and private limited companies which are fully or partly owned by a municipal port authority.

Balthazar and Brooks (2006) also address the concept of devolution within their governance model, arguing that it is a necessity which can benefit the development of management, the optimal utilisation of resources, and in challenging the regulation development of port operation. As such, it produces opportunities for 'development' to be an ongoing process so far as ports are concerned. Related to this, Vieira et al., (2014) presents the concept of devolution, stating that initiatives are being created as ports begin to devolve but try to stay in line with the market needs of the transportation industry and attempt to transition and keep up with technological competition from business(Vieira, Neto, et al., 2014; Vieira, Silva, et al., 2014).

In line with this statement, this thesis aims to provide recommendations about devolution to Danish ports via the expert committee established by the Danish Ministry of Transport, Building and Housing.

This thesis purports to contribute to the theoretical foundation of the governance model, which would provide sufficient support for enquiring into this phenomenon of entrepreneurial alertness and structural embeddedness. Balthazar and Brooks (2007) define port governance using a 'environmental fit' matching framework with three elements (environment, strategy, and structure), and where the outcome has been described as performance (Vieira et al., 2014).

This model addresses the novelty of port governance, and how the three different elements together provide a degree of customisation. What this means for this thesis is that each element is applied to the three different research questions, and through analysis a new hybrid governance model will be created. In the context of the governance model, this thesis therefore departs from Brooks and Cullinane (2006) in terms of port classification that would be relevant for each element so that government structure and port function can be justified. The contribution of these three papers is discussed further in the contribution section(Brooks & Cullinane, 2006a).

7.PROBLEM STATEMENT

This thesis combines the empirical and theoretical enquiries to arrive at the following overall question: **'How can port authorities develop their business in the current port governance landscape?'**

a) Co-operation port authorities and Opportunity Recognition

In the first stream of research, it is argued that to develop new business, port authorities have to show more alertness towards entrepreneurial strategies. To accomplish this, we need to investigate the antecedents of alertness to recognise opportunities that could be turned into business-like strategies. To further investigate this phenomenon, this thesis focuses on the following question: "How do the coopetition ports recognise opportunities to creates 'business like-strategies'?" To answers this question, the following questions were investigated:

1. What are the 'antecedents' which were the catalyst of the mergers that correlate with entrepreneurial alertness?
2. What are the 'antecedents' in opportunity recognition that drive coopetition ports to ultimately create value?
3. What are the 'antecedents' coopetition ports need in order to avoid value void outcome or creating new opportunities?

b) Danish port authority and digital data sharing in interorganisational networks

The second stream of research focused on the digital resource sharing strategy of Danish port authorities. It is argued that a digital resource sharing strategy embodies the essence of entrepreneurial alertness. This is due to the existence of the antecedents of openness to experience and the ambition of the Danish ports to create more business-like strategies for both customers and port authorities alike. To further investigate this phenomenon, this thesis focuses on the following questions:

(1) How does the Danish port authority and its community define digital resource sharing?
(2) How does the Danish port community define the port logistical process?
(3) What are the challenges of sharing resources digitally beyond the role of the landlord port and its impact on the port's legal and jurisdictional system?

c) Application of digitalisation to achieve efficiency in port performance

The third stream of research coalesced the first and the second stream to test out the theory that the entrepreneurial digital resource sharing platform strategy (paper one) would create opportunity to share more information in a trustful, neutral and transparent form of one single truth (paper two). In turn, this would create greater information flow within the port actors' central network, increase collaboration between non-central and central port actors, and create a denser network. To answer the question 'How can port authorities achieve efficiency in their port performance through digitalisation and increase structural embeddedness in their network?', the investigation needs to be broken down into three parts.

a) What are the indicators that are under the port authorities' judicial role which contribute to port performance efficiency?
b) What are the challenges faced by port authorities in increasing port networks' density?
c) How can port authorities increase information accessibility so that it contributes to the efficiency of port authorities' performance?

In order to investigate these three-research objective of this thesis, the section first introduces the synthesis of the three papers in section (8). Then second the thesis introduces the research methodology in section (9) undertaken by this thesis to analysed using a three-part research methodology which is extended in a longitudinal study.

8. SYNTHESISING THE THREE PAPERS UNDER ONE UMBRELLA

This thesis positions itself at a point where small to medium-sized port authorities in the Nordic region have started reforming themselves, where their aim is digital transformation to become entrepreneurial port authorities which display business-like performance. Regarding the contribution to this domain stream, this thesis attempts to adopt an approach whereby it is 'contributing to an understudying unique problem', where the research context in all three facets of the paper contributes to a problem using an interpretive approach. The main topics that this thesis contributes to are port development, port governance and port performance. As discussed in the theoretical problem, the current governance model (Baltazar and Brooks, 2006) views port performance as a function of efficiency and effectiveness which can contribute to economic returns through a fit of strategy, structure, and environment. Although this framework has been revisited for improvement (Brooks, 2017), it nonetheless contains certain variables of autonomy, transparency, trust, neutrality and entrepreneurship which have still yet to be investigated in the construct of the port governance 'environment'. The intention of this thesis is to synthesise our contribution to reconfigure the 'port governance' element of port governance. Following the construct of a matching framework introduced by Baltazar and Brooks (2006) and Brooks and Cullinane (2006) in a defined port governance model, this thesis argues that more research needs to be done on the reverse contribution of structure, strategy and efficiency to the reconfiguration of the port governance 'environment' (Figure 3).

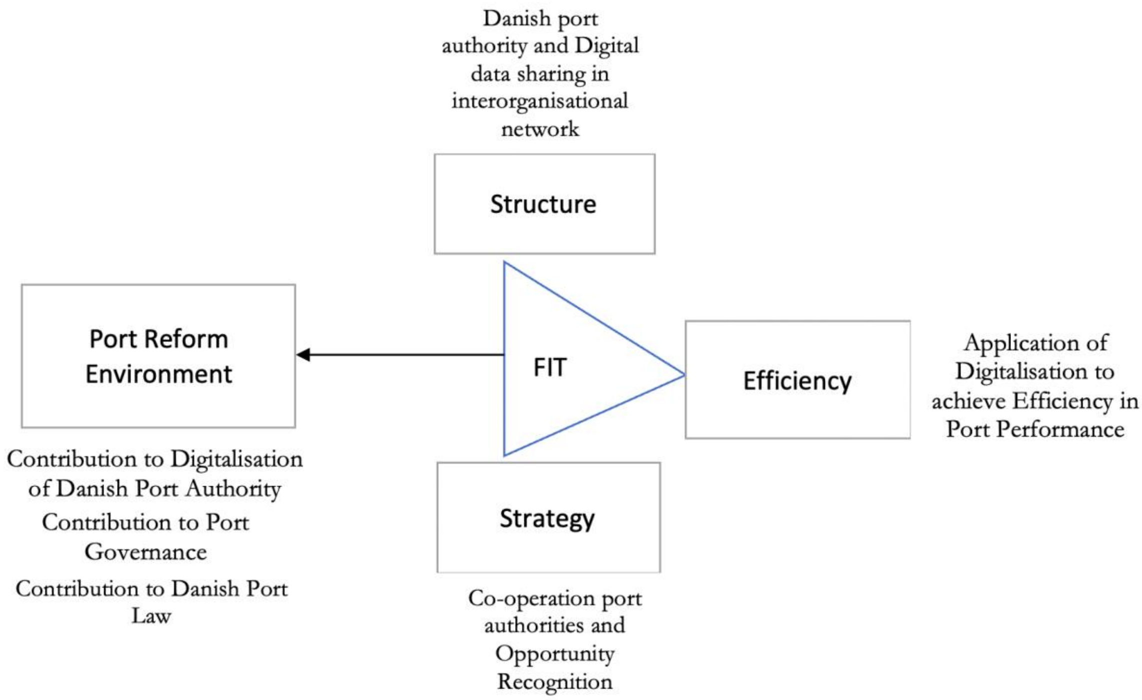


Figure 3:Adopted Baltazar and Brooks (2006) and Brooks and Cullinane (2006) and Authors contribution

In Section (1), the first paper contributes to the 'strategy' variable of the port authority. Nordic ports were always viewed as landlords, infrastructure providers or geographical locations where vessels would load and unload cargo. This understanding has changed in recent years, whereby port authorities' responsibilities have developed. Their identify and status has changed from being a landlord port making strategic decisions about land lease for optimal utilisation of the land to being an entrepreneurial port which, whilst still holding the general title of landlord port, is pushing the boundaries regarding entrepreneurial development as any business organisation would. One of the opportunities that ports are investigating is digitalisation, and whether it holds value to the port authority. The first paper contributes to this inquiry by investigating successful strategies that have created value for small to medium-sized ports in the Nordic region. In the matching framework (Balthazar and Brooks, 2008), the element of strategy is defined as a two-dimensional product, with market scope and competitive emphasis. Product and market scope refer to the products offered by the port, and the market to whom the offering is made (Balthazar and Brooks, 2008). This thesis, emerging from paper one, makes the contribution that port authorities with a public limited liability ownership structure have more opportunity to create strategies which have synergy, which learn from the market, and which experiments with new ideas based on their prior business knowledge. This thesis emphasises the fact that port governance, and the repeated, iterative changes made to the governance, tend to give port authorities the autonomy to recognise more business-like opportunities.

However, the paper also investigates more deeply into different forms of opportunity that inspire top level policy makers to form strategies. The paper leads to opportunity creation, discovery and recognition and analysis that top level policy makers tends to focus on certain types of opportunity based on their governance status. The research is carried out by collecting data from top level port authorities, ranging from medium to small sized ports. These ports are both pre-reform and reformed in a collaborative structure, wherein they are in the process of developing strategies with consideration of their newly expanded jurisdiction.

In Section (2), the second paper contributes to the reconfiguration of 'structure' on port governance. The existence of digitalisation opportunities in the environment combined with restrictions in terms of executing radical innovations because of the constraining regulations of Danish port law can become a deterrent to port business development. As such, this thesis takes a stand on the question as to how port authorities are developing digitally in lieu of new Danish port governance regulations. The contribution to 'structure' explains that Danish ports are already testing the boundaries of digitalisation by sharing information digitally so that infrastructure accessibility can be optimised. At the same time, this digital development has opened a new dimension of insights in which ports can recognise opportunity and attract new business. However, Danish port governance has not considered the implication of the role of port authorities in the digitalisation of port law. This section highlights what needs to be reconfigured in port governance so that a more neutral and transparent structure can be achieved. In the matching framework, the element structure is defined by two concepts, that of centralization and standardization. The centralization concept is explained by Balthazar and Brooks (2007: 390-391) as 'the extent at which important decisions are made at higher levels of the organisation' and standardization as 'extent at which there are behavioural rules and norms and operating procedures in the organisation' (Baltazar & Brooks, 2006). The concept of resource sharing is introduced in the 'structure' to highlight the current development of digitalization and its lack of alignment to the port governance. The digital information sharing of ports has raised question in terms of what will be shared and how this will affect the value, trust and efficiency when there is not regulation on the port authority's role. We realize that most of the ports of digital resource exchange projects focused on making a part of the business processes digital resources exchangeable rather than optimize the whole business processes from customer journey perspective that consist of the following: port controls' port call optimization, intra-port operation and terminals hinterland connectivity . The third paper states that digital resources consist of high competition advantages to our port service providers and at the same time Danish port authorities have a high dependency on the digital resources. It imperative that we build data sharing platform based on both trust, customer value and formal contract agreement. The paper argues that, hybrid port authorities will be the first to experience this value shift in their interorganisational networks. This thesis concludes that the that the existence of digital resource exchange will provide some drastic changes to interorganisational networks, thereby increasing the need for a neutral port community system (PCS) that governs digital resources in the network. The thesis presents an logistical process model with dependencies as framework in paper 3 to highlight the 'ordering and 'operational' steps that make digital resource sharing possible in the intraorganizational governance of a PCS. The PCS will have the attributes of traceability, monitoring and standardisation and will connect to other platforms such as the Hybrid Port Authority Digital Exchange Platform.

Section (3) of the second paper contributes to the 'performance' variable of the port authority, and ask how digitalisation can create efficiency in port performance. The focus of this paper is on ports authorities, commercial departments and port users. It investigates how each presents a different perspective of the challenges of port efficiency. From the perspective of the port authority, the focus is on the scope drawn by the boundaries of the responsibility, which is predominantly port call notification, dangerous cargo notification and vessel inspection. From the commercial perspective, one of the greatest challenges is identifying the specific scope or area of operations requiring efficiency while simultaneously improving performance of all the port users without compromising the position of any of the users and providing continuous opportunities for growth in the similar context. This paper provides an artifact and a methodology which can be adopted by Danish port authorities in order to optimise their daily business processes. This is achieved by digitalising and simultaneously optimising their internal performance in relation to vessel berth and crane allocation and building a positive collaborative effect with other port actors which is based on transparency and trust in the port centrality network. The goal of the third paper is to focus on the artifact that contribute to solving the problem by increasing the density of the network as well as increasing value to our customers. Berth allocation and other port call services are done manually through communication with the central network actors that provides various challenges to port performance efficiency. The problem defined above is chosen for their value capturing / customer centric problem. Through the mixed method of action research and design science, we concluded that quay allocation booking system including crane booking was of primary importance for selection in the digitalisation project. The rationale for this was that providing accessibility to infrastructure is the primary function of the port authority and is therefore directly related to existing customer value. In addition to the problem selection, it was essential that its design and solution contributes to the port performance literature and to the efficiency objective in the port call process. The artifact aims to make 'information available' through a denser network, thereby improving the centrality of the network.

Since we had the opportunity to be present at the research site from January 2019 to March 2019 , due to the employment as a research consultant in Ports of Esbjerg, and Port of Køge for differing periods of time, it was possible to evaluate and receive feedback implementation of the artifact from Port of Køge as well as other stakeholders situated on the research site. As an employee of these three ports, we also had access to a range of port actors. In order to leverage this opportunity, we implemented the methodology of action research alongside with design science framework and collected data from field visits, conducted presentations in councils and invited focus groups, and through participation observation.

9.RESEARCH METHODOLOGY OF THE THESIS

9.1 RESEARCH PHILOSOPHY

In this section we discuss the philosophical position of our research. First, we identify out theoretical paradigm that will be our foundation for conducting in-depth research. The research philosophy mentions three main elements: ontology, epistemology, and methodology, which are important three consideration of the research paradigm. This thesis follows philosophy of positivism and adopts the logical formulation of abductive reasoning for its longitudinal data collection and data analysis.

9.1.1. RESEARCH DESIGN

The uniqueness of longitudinal research provides this thesis with the opportunity to combine various methodologies and analytical methods for data collection which can describe the research objective of this thesis. The chart below (Figure 4: Research Design) explains the journey of the researcher in collecting the data and the physical movement of the researcher in different environments. My journey in data collection as a PhD fellow started with investigating archival documents on Danish port authorities. After this, I undertook a test pilot interview with the Danish Port Association, and by the end of 2016 the Danish Port Authorities were selected as my unit of analysis for this thesis.

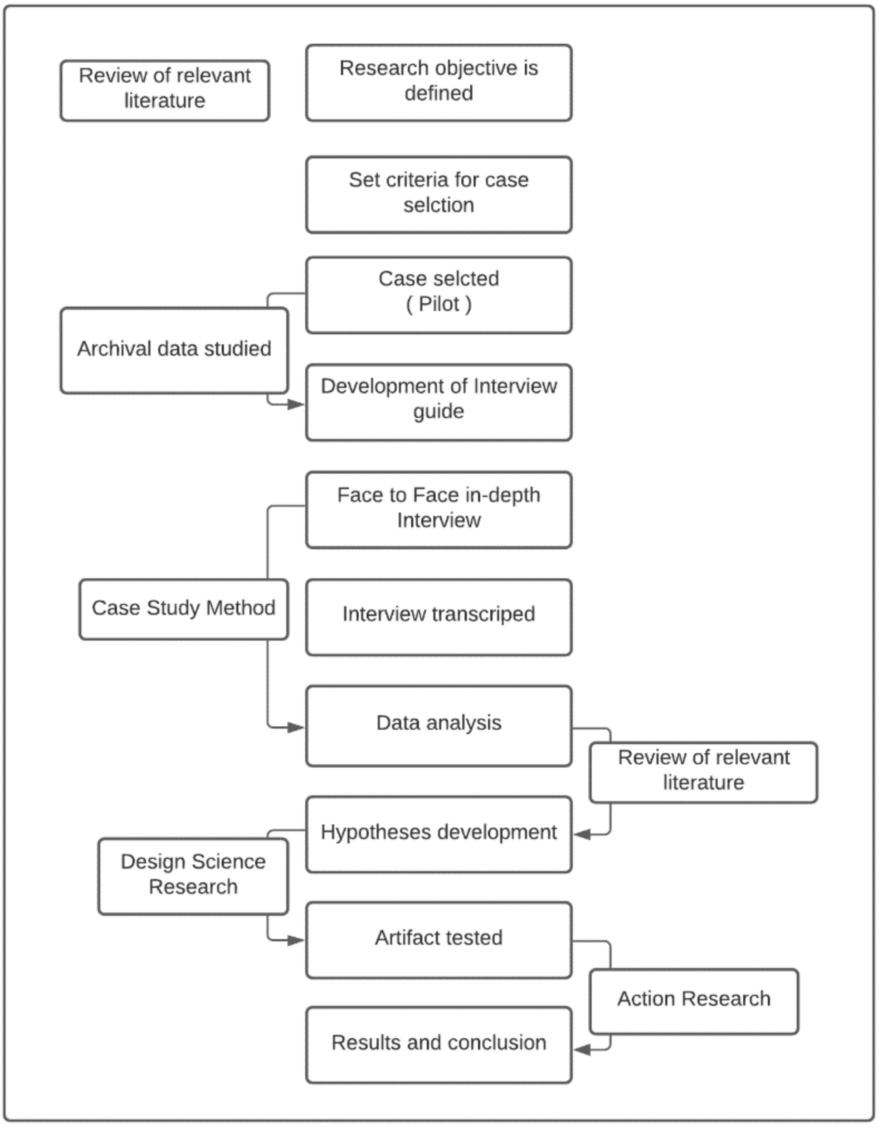


Figure 4: Research Design

9.1.2. Mixed Method

The combination of case study research, design science and action research **(See table 2)** give the researcher the freedom to investigate a specific problem directly from the source as it occurred in the environment (Eden & Huxham, 1996; Miles & Huberman, 1994; Paré, 2004). It presents the us with the opportunity to acquire knowledge about the unique applications used for specific purposes that are not replicated by other port authorities. (Hult & Lennung, 1980) explains that action research gives the researcher the opportunity to continuously design, evaluate and improve their theories in their aural habitat. For instance, it lets the port authority collaborate with the researcher on the initial ideas for the artifact and to give non-technical employees a platform to give feedback on something very technical. This creates a sense of contribution and control for those employees who were initially sceptical or worried about their job or a loss of control over their business processes. For instance, the research question of the third paper concentrates on the how – how the port authority's application contributes to a denser network and digitalisation project which compliments perfectly with the case study and action research methods (Baskerville, 1999; Miles & Huberman, 1994; Paré, 2004; Yin, 2003). Through case study research and action research methodology, the researcher can test this, mapping the 'how' processes and undertaking an in-depth analysis of the 'how' in the research question. Design science methodology is adopted to develop and explain the meticulous procedure of building the application for Port of Eastbjerg, iterating the design, and improving the prototype so as to solve the problem. It is important to state that each of these methods has limitations. Therefore, through case study method initially, opportunity antecedents, resource dependency, performance indicators that are needed through the three papers are highlighted in the section of data analysis.

The third paper adopts design science to build the mental process of the application while simultaneously testing the application and iterating it through action research. In addition, both action research and design science complement each other by providing an explanation of the processes and approachability of the actual problem. Finally, since network structural embeddedness theory is used in the third paper to build the application, which aims to aid port efficiency performance, this thesis believes that it is necessary to have a continuous evaluation of the application or artifact. This can be provided through action research, where demos can be presented to the actual user and iteration performed. Moreover, the combination of action research and design science provides a structured way to deal with the problem and application of the solution.

The paper adopts the methodology of action research, case study research and design science research to discuss the whole process to investigate the digitalisation project of the port authority. This paper argues that to fully understand the creation, processes, and implementation of digitalisation for this thesis research objective, the research methodologies need to be combined in a comprehensive manner.

Table 2: Mixed Method Research

Paper	Research question	Research Method	Data Considered
Paper One	"How do the coopetition ports recognise opportunities to creates 'business like-strategies'?"	Case study research	Interview Conducted December 2016 – December 2017 In-depth interviews Secondary interviews (2)
Paper Two	(1) How does the Danish port authority and its community define digital resource sharing? (2) How does the Danish port community define the port logistical process? (3) What are the challenges of sharing resources digitally beyond the role of the landlord port and its impact on the port's legal and jurisdictional system?	Case study research	Interview Conducted December 2016 – December 2017 In-depth interviews Secondary interviews (2)
Paper Three	'How can port authorities achieve efficiency in their port performance through digitalisation and increase structural embeddedness in their network?'	Case study research	- 40 structured in-depth interviews -Two Secondary interviews
		Design Science	70 structured interviews - Three Workshops - Four presentations
		Action Research	- 40 structured in-depth interviews - Two Secondary interviews Field Visits Participant observation Work Focus groups

9.1.3. CASE SELECTION

The first criteria to consider : the papers the port authorities are chosen for their ability to exhibit some degree of entrepreneurial behaviour, i.e., having the characteristic of an 'autonomous port authority with business-like performance'. These ports were first collected through test pilot interviews, or newsletter information produced by the port association of their respective countries or by snowball sampling.
For the managerial cooperation ports (first paper) we selected specifically fully municipally owned limited company in Denmark, Finland, and Sweden. The objective of the first paper of this thesis was to identify port authorities' 'entrepreneurial alertness', whereby ports are promoted to expand their governance model boundaries in order to develop as an autonomous business organisation and to develop strategies that would resonate with 'alertness'.

For the resource sharing (second paper) and for application of digitalisation (third paper), Danish port authorities were selected based on their forms of organisation; either they were municipally self-governed port or fully or partially municipally owned limited company. The objective of the second paper of this thesis was to identify port authorities 'resource dependency' whereby ports will legally be able to expand their boundaries digitally through data sharing with their interorganisational network. The objective of the third paper of this thesis was to identify the application of digitalisation, whereby port authority achieve an denser network of efficient port performance.

The selection of port cases on the basis of in-depth research was based on the logic of demonstrating the various and different stages of reform (Table 3) and development; this means that the port authorities selected were at different stages of development, and different contexts were explored in the three different papers. This aspect of the case study design resulted in the generalizability of the findings across the wide port authorities' spectrum.
According to the second criterion, states that the ports selected are either medium or small sized ports. Specifically, following investigated ports authorities were chosen, for the reasons outlined below:

Table 3: Stages of Reform

Port Authority	Country	Ownership	Reformed Status	Size
Port of Køge	Denmark	MSG	2000	S
Port of Esbjerg	Denmark	MSG	2000	M
Port of Aarhus	Denmark	MSG	2000	M
Port of Associated Danish Port (ADP)	Denmark	MOLG	2016	M
Port of Aalborg	Denmark	MSG	2000	M
Port of Odense	Denmark	MOLG	2017	M
Port of Kvarken	Sweden	LTD	2015	S
Port of Haminakotka	Finland	LTD	2012	M

9.2.DATA COLLECTION

This thesis is influenced by Miles and Huberman (1984) in terms of how qualitative research is understood and implemented, noting that qualitative data should be considered as rich in description and detailed in its explanation of processes occurring in the context. Taking the scope (i.e., the port authority's different strategy, resources dependencies, and port performance indicators) and research context (i.e., access to data, documents, and organisation) into consideration, the possibility of fruitful explanation, assessing low causality and preserving chronological flow can support the researcher. This thesis follows a longitudinal study, defined as "a research study that repeats observation repetitively over a period, sometimes over decades". The table 3 illustrates the longitudinal data collection journey over a period of three years. For this thesis, longitudinal data was collected between 2016 and 2019. The data consists mainly of primary semi-structured interviews and field work. Hypothesis development and artifact testing were undertaken at the end of the research period (2018-9). The processes of data collection are described below, specifically the techniques used to get access to the high-quality experts working in the field, and the necessary steps required with regards to issues of confidentiality.

- **YEAR 2016 -2017**

The first wave of the data collection, which set the scene for this thesis with regards to 'strategy', lasted 12 months and provided a solid foundation into the typology of port authorities and management intent, and provided a comparison to other ports with similar ownership and configuration. Interview appointments were requested by email, and a short description of the research was attached to the email. These emails were targeted to the C-level management of cooperation port authorities in Denmark, Sweden, and Finland. In 2016, there was five such ports in the Nordic region, and I was able to secure access to three of them. Interviews were carried out using a snowball technique in which the people were asked to suggest the next person that should be interviewed about this phenomenon. To commence the interview process, the Port Association was asked to introduce my research objective to the Danish port authorities. This was a success as the majority of the ports replied via email offering interviews with their executive board. The interviews were carried out across the three cooperation ports, and involved the Chairman of the company, the Chief Executive Officer (CEO), the Chief Finance Officer (CFO) and the Chief Commercial Officer (COO).

In total, five ports (22 people) were interviewed, of which three were cooperation port authorities. In the cooperation port context, in the Port of Haminakotka, three interviews were conducted (with the CEO, CFO and COO); in the Port of ADP, there were four interviews with personnel from the top management level, there was an opportunity to interview the CFO twice for a second paper; in Kvarken, there were three interviews (again, with the CEO, CFO and COO). For data triangulation purposes, five interviews in three multipurpose ports were carried out (with the CEO, CFO and four CCOs) in order to gain a greater understanding of how they compared to cooperative ports. The triangulation interview was held with the CCO of the Port of Aarhus in the office of Dankse Haven. The other meetings were with the Director of the Port of Aalborg and the CCO of the Port of Esbjerg, with the purpose of triangulating the data collected from the managerial co-operated port. From the perspective of the port users and port service providers, the CEO of the Danish Port Association, the Finnish Port Association and the Swedish Port Association Were subsequently interviewed. In addition, the Chairman and CEO of the Danish Ship Broker Association and the Head of Politics of Danish Freight Forwarders were also interviewed in the same week.

All the interviewees gave permission and agreed willingly to take part in the interviews. The first interviews began in February 2017, and were spread at regular intervals until September 2017. The data collection in the three main cases took place consecutively in order to integrate constructive flow, so that there would be a proper overlap of data. This made it easier to integrate the three papers into one thesis.

- **YEAR 2017-2018**

The second wave of data collection was done in order to ensure that there was a case-specific component – specifically the digitalisation of resource sharing which is related to structure. The data interview process began in September 2017 and ended in December 2018. After the first wave of data was collected, with the intention of building the foundation of this thesis and setting the scene, it became clear that the theme of digitalisation was the topic of conversation in both Denmark and Finland. This was corroborated by the port users in Danish and well as Finish ports. Since most of the Danish port authority executives were already known to me, it was reasonably straightforward to gain access to them again in order to investigate this topic. The process consisted of emailing the executive officers of the port authorities in Denmark and requesting an interview. In this wave, I visited the interview transcripts from before in order to consider the data when it had been analysed through the lens of resource sharing, and to see whether any of the data helped to answer our second wave questions. This was feasible because of the abductive approach used. Having already interviewed the CEO of the Port of Esbjerg, further interviews were held with the CFO and the CCO in order to corroborate their perspectives and their digitalisation plans, and to understand what projects they were investing in. At the same time, we continued our conversation with the CFO of ADP to learn more of their digitalisation project.

I also interviewed the CEO of SafeSeaNet in order to gain insight from other experts on digitalisation in European ports. In-depth interviews were also held with the Danish Ship Brokers Association's chairman and its CEO in order to ascertain their views on current digitalisation projects, what ambitions ports hold, and whether they would collaborate with them. Due to a conflict of scheduling it was not possible to review our interview with the Danish Freight Forwarder Association. For the purpose of triangulation, the Shipping DK CCO, who is also on the board of directors in the above mentioned association, was also interviewed in order to corroborate the data collected from the Freight Forwarding Association.

- **YEAR 2018- 2019**

The purpose of the third wave of data collection was to test the hypothesis generated from the 'strategy' and 'structure' of wave one and wave two. This data collection period lasted from January 2018 to March 2019, and contributed an artifact to accelerate digitalisation in Danish port authorities. This contributed to the 'performance' part of this thesis. This artifact was developed based on design science framework (Section11.6.1) and action research (Section 11.6.3). Between January 2018 and March 2019, I was employed to work as a research consultant with the Port of Esbjerg, the Port of North and the Port of Køge. This is where I got the opportunity to test my hypothesis and build an ‘artifact’ for these three ports. As I was privy to a high level of confidentiality, the interviews taken were not recorded but rather recorded as field reports.

In the Port of Esbjerg, I was employed for eight months while collecting my data for the third wave. This enabled me to test my thesis hypothesis regarding the increasing interaction between central actors’ agents and stevedores. For this I interviewed personnel in port control (three assistant harbour masters) and the technical department (the chief operation officers, four engineers and one service assistant). Interviews were also carried out with the CCO and CFO of the Port of Esbjerg to align their intention, investment plan and strategy with the contribution of the developed artifact (see paper three). My workspace in the Port of Esbjerg was in the commercial department (on the first floor of the Port Authority) but I took the liberty of moving to the ground floor, near the harbour master division, in order to observe the daily interaction of my colleagues. This enables me to observe how they handle problems and to gain insight into the way they work with stevedores and agents. This provided me the opportunity to interview two stevedores at the Port of Esbjerg and participate in their team meeting.

From April to June 2018, I divided the process of implementing and evaluating the artifact between the Port of Esbjerg and the Port of Koge. In the Port of Koge, I interviewed the CEO and other executive members the for their feedback on the artifact, and the extent to which it was reliable and generalisable to all three ports. The final test of the artifact was done in the Port of Køge, where the CEO and one Stevedore were interviewed for feedback on the artifact. This artifact was also part of my consultancy report on Digitalisation Projects. The artifact presented in this thesis is general and reliable whereas the one provided in the consultancy report is customised per the business process of each port.

Time	Data Collection method	Type of Company	Unit of Analysis
December 2016 – December 2017	Interview 28 structured in-depth interviews 2 secondary interviews	Port Authority Danish Port Companies Association DHL Shipping.DK Danish Port Association Finnish Port Association Swedish Port Association Danish Ship Broker Danish Freight Forwarding Association	Chief Executive officer Technical Department Stevedores Agents Port control
January 2018 – December 2018	Interview 70 structured interviews Workshop 3 Workshops Presentation 4 presentations	Port Authority Ship Broker Association Danish Freight Association Danish Port Association Danish Shipping Association DHL Shipping.DK Danish Safe Sea net Freight Forwarding Company	Technical Department Harbour Control Crane Operators Financial Department Maritime Department Executive Management (C-Level) Agents Stevedores Pilots

January 2018 - March 2019	Field Notes Field Visits Participant observation Work Focus groups	Port Authority Danish Port Association Danish Shipping Association Freight Forwarding company	Technical Department Harbour Control Crane Operators Financial Department Maritime Department

Table 4:Journey of Data Collection

9.3.DATA ANALYSIS

The full and complete analysis of data is crucial. As such, the interviews were transcribed and translated by a Danish-speaking professional. Following this process, the data were coded and ascribed different colours in order to understand the direction of enquiry. The data analysis coding was done on NVivo Software provided by the Copenhagen Business School. When the data had been uploaded into NVivo, it was formatted for standardisation. To gain an initial feel of the data, 'In vivo coding' using mixed methods was used as an underlying method for analysing the data in the first cycle of coding, and also in the subsequent second cycle of coding.

1. PAPER ONE

The coding was divided into two coding cycle. (1) coding done with In vivo coding to highlight the keyword that the interviewee used for specific questions on explaining digitalisation, (2) elaborative coding was used to code based on the previous studies done on opportunity recognition theory and port strategy ; In addition this coding made it possible for this study corroborate pervious opportunity research with port authority research (3) value coding was used to highlight the antecedents connected to entrepreneurial alertness, autonomy and creditability . We believe trust is an important keyword for entrepreneurial strategies to achieve value sought, especially if the value port aims to create is essential for the survival of the port authority. So, value coding is used to acknowledge that trust interaction between different port actors. (4) theoretical coding was used to further examine the antecedents of alertness, which brought us to the three antecedents need to create vale sought. Moreover, the theoretical coding specifies the relationship between categories and moves the analytical story in a theoretical direction (Thornberg and Charmaz, 2014). One of them being entrepreneurial zealousness. The value coding, with in vivo and elaborative coding contribute to the next step of reflect and refine to answer our research question. In addition, the researchers' dialogue (i.e., memos and field notes) are also analysed because they repeat or resonate the interviewees' non-verbal communication.

- **CODE AND NODE**

This section has explained the data analysis method and the procedures for capturing and summarising what the data show. In the following section, we explain the key nodes which were chosen from the literature to code the data, focusing particularly on the use of elaborative and theoretical coding. In this analysis, the port authority strategy and opportunity recognition literature used nodes that were initially used to highlight the antecedents of alertness, autonomy, prior knowledge and personality traits. Following this, value coding was used to illustrate the important strategies which highlight the entrepreneurial essence of innovation and proactiveness, and which were different from landlord port strategies. Each strategy was coded under the antecedents (e.g. alertness, trust or autonomy) and was also given the code of either value sought or value void. Following this, elaborative coding was used to shape each antecedent into a sub node, e.g. entrepreneurial zealousness had the sub node of openness to experience, which was explained using keywords such as 'curious', 'imagine' and 'mindset'. This provides insights into what each expert executive thought about strategies or opportunities. The second cycle coded operationalising alertness antecedents into a more entrepreneurial antecedent of zealousness which is suitable for port authorities that are government organisations, and are only allowed to play the role of an initiator. The theoretical coding highlighted the positive impact of entrepreneurial zealousness on value sought and a negative impact when excluded from strategies that were entrepreneurial in nature. This is further reflected in our contribution and conclusion section as well.

2. PAPER TWO

Firstly, the coding was undertaken using Nvivo (Thornberg and Charmaz, 2014 and Strauss, 2015), in which keywords used by the interviewees for specific questions on explaining port function, structural embedded relationship and resources were highlighted. This mean that these types of functions could be isolated and then translated into the business process where digital resources are exchanged, and where trust or the contract relationship is created. Secondly, processes coding was used to map a repetitive form of action, namely the interaction between the port authority and the port user in order to accomplish a particular port activity. In addition, the coding was done to map resources dependencies and organisational rigidity to exchange certain digital resources.

Thirdly, value coding was used to highlight the relationship aspect of resource exchange, and to emphasise the challenges of collaboration and where competition occurred. Trust is a crucial keyword for resource exchange, especially if the resource is essential for the survival of the port authority. As such, value coding is used to acknowledge this trust interaction between different port actors.

Fourthly, in the second coding cycle, theoretical coding was used to map the key resources that connect to the 'creating' category of port function, and connects it to the established governance literature. The value coding, with NVivo analysis and process coding contributes to the next step, of reflection and refinement, in order to answer the research question.

- **CODES AND NODES**

In the following section, the choice of key nodes (codes) from the literature is explained, in particular how this relates to both processes coding and theoretical coding. In the analysis, port governance and port authority were engaged into nodes that were initially used to highlight the port function that required digital resources. This narrowed the focus to specific port function that creates value to customers but still exists within the parameters of services provided by port authorities. Per Brooks & Cullinane, 2006a , this paper limits itself to the port service that ports authorities are legally responsible to perform efficiently. Value coding is then used to illustrate important port activities of hybrid port authorities, which provide both physical and digital services to port users and service providers. The functions of each port are broken down into sub digital activities which together make a port function. For example, port call procedure is a port activity that is part of the service for vessels or terminals (Brooks & Cullinane, 2006b; Zhang et al., 2018b). This includes a vessel berth allocation process, cargo loading and unloading operation planning, waste disposal schedule, slap oil pickup booking, crew change permission procedure, and provision for vessel crew and equipment maintenance.

Following this, process coding is used to help illustrate sub digital port services and the exchange of digital resources between port users and port service providers. This provides useful insights about the interactions between different port actors and helps us narrow down what are considered the most important digital resources, and why they are shared with port authorities. This coding is also used to highlight the dependencies of various digital resources on port activities; for instance, port call consists of the berth allocation processes, where digital resources provide a port call optimisation platform that shows the live booking and allotting status of the vessel by port control. To achieve this, the port authority is dependent on digital resources such as the ETA live update from the agent or the stevedore. The second cycle theoretical code was used to identify the most valued problem in the port authority processes which can provide reliability, fit and usability for agents and stevedores. Theoretical coding highlighted the impact of present governance on the potential possibility of exchanging digital resources. This is further reflected in the contribution and conclusion section.

3. PAPER THREE

The 3rd wave data was coding by dividing into two coding cycle. First, the coding done with In vivo coding to highlight the keyword that the interviewee used for specific questions on explaining port performance that they use as indicators to measure their efficiency development, so that we can isolate those indicators and translate it into business process where central actors' communication and transfer information (See Paper 3, Section 7),

Second, the coding value coding was used to map the key port performance that port authorities and central actors deem important for efficient port performance. In addition this coding was used to highlight the challenges we have in respect to these port performances;

Third , the second cycle of coding done with (3) Pattern coding was used to highlight the interaction of central actor to communication information and use this coding to illustrate the link between central actors (See section 9.1 & 9.2 of Paper 3). We believe trust is an important keyword for communication commercially competitive information to a non-central actor, especially if the information is essential for providing effect "accessibility of infrastructure" of the port authority to the central actor. So, value coding is used to acknowledge that trust interaction between different port central actors and non-central actors. The value coding, with invivo and process coding contribute to the next step of reflect and refine to prove the suggested prepositions of this study.

- **CODES AND NODES**

In the following section we explain the key nodes were chosen from literature to code the data especially when using evaluation and value coding. In the analysis, port performance literature and network centrality were engaged in nodes that were used to first select the most essential port performance indicators and the challenges to each specific port performance indicator. Then we used value coding to illustrate the important indicators in sequence so that we know which sub indicators artifact should be build first to achieve the foundation for efficiency in that particular port performance indicators. As each port performance indicator broken down into sub indicators, that together make a performance indicator. For example, Intra port operation; consist of container lifts per hour (per crane); Use of manpower (hours) per handled tones/numbers of cargo; Damage costs per TEU; Number of damages per operation or per day/month (new cars, containers, rolling stock);

Number of interruptions of work caused by equipment) and value coding assist us to picking the right sub indicators to build artifact on in the next step of research analysis. This coding also highlighted the most valued problem in port authority processes which can provide reliability, fit and usability for the agents and stevedores. The pattern coding highlighted the links between different central and non-central actors. This was future refined with further reflecting and refining the interactions in the design science and action research of the 3rd papers research methodology.

BIBLIOGRAPHY

Acciaro, M., Ghiara, H., & Cusano, M. I. (2014). Energy management in seaports_ A new role for port authorities. *Energy Policy*, *71*(C), 4–12. https://doi.org/10.1016/j.enpol.2014.04.013

Adenso-Díaz, B., Álvarez, N. G., & Alba, J. A. L. (2020). A fuzzy AHP classification of container terminals. *Maritime Economics & Logistics*, *22*(2), 218–238. https://doi.org/10.1057/s41278-019-00144-4

Akyuz, G. A., & Erkan, T. E. (2010). *Supply chain performance measurement: a literature review*. *48*(17), 5137–5155.

Andersson, U., Björkman, I., & Forsgren, M. (2005). *Managing subsidiary knowledge creation: The effect of control mechanisms on subsidiary local embeddedness*. *14*(5), 521–538.

Andersson, U., Holm, D. B., & Johanson, M. (2015). *Managing Opportunity Development in Business Networks*. 27–48. https://doi.org/10.1057/9780230379695_2

Arentz, J., Sautet, F., & Storr, V. (2012). Prior-knowledge and opportunity identification. *Small Business Economics*, *41*(2), 461–478. https://doi.org/10.1007/s11187-012-9437-9

Balen, M. van, Dooms, M., & Haezendonck, E. (2014). River tourism development: The case of the port of Brussels. *Research in Transportation Business & Management*, *13*(C), 71–79. https://doi.org/10.1016/j.rtbm.2014.10.014

Baltazar, R., & Brooks, M. R. (2006). Chapter 17 Port Governance, Devolution and the Matching Framework: A Configuration Theory Approach. *Research in Transportation Economics*, *17*, 379–403. https://doi.org/10.1016/s0739-8859(06)17017-1

Baskerville, R. L. (1999). Investigating Information Systems with Action Research. *Communications of the Association for Information Systems*, *2*. https://doi.org/10.17705/1cais.00219

Berg, R. V. den, Langen, P. W. D., & Costa, C. R. (2012). The role of port authorities in new intermodal service development; the case of Barcelona Port Authority. *Research in Transportation Business & Management*, *5*(C), 78–84. https://doi.org/10.1016/j.rtbm.2012.11.003

Bhagavatula, S., Elfring, T., Tilburg, A. van, & Bunt, G. G. van de. (2010). How social and human capital influence opportunity recognition and resource mobilization in India's handloom industry. *Journal of Business Venturing*, *25*(3), 245–260. https://doi.org/10.1016/j.jbusvent.2008.10.006

Bichou, K, & Gray, R. (2005). A critical review of conventional terminology for classifying seaports. *Transportation Research Part A: Policy and Practice*, *39*(1), 75–92. https://doi.org/10.1016/j.tra.2004.11.003

Bichou, Khalid. (2006). Chapter 24 Review of Port Performance Approaches and a Supply Chain Framework to Port Performance Benchmarking. *Research in Transportation Economics*, *17*, 567–598. https://doi.org/10.1016/s0739-8859(06)17024-9

Bichou, Khalid, & Gray, R. (2004). A logistics and supply chain management approach to port performance measurement. *Maritime Policy & Management*, *31*(1), 47–67. https://doi.org/10.1080/0308883032000174454

Bliemel, M. J. (2010). *ENTREPRENEURIAL NETWORKS: A REVIEW, METHODOLOGY AND TYPOLOGY*.

Bray, S., Caggiani, L., & Ottomanelli, M. (2015). Measuring Transport Systems Efficiency Under Uncertainty by Fuzzy Sets Theory Based Data Envelopment Analysis: Theoretical and Practical Comparison with Traditional DEA Model. *Transportation Research Procedia*, *5*, 186–200. https://doi.org/10.1016/j.trpro.2015.01.005

Brooks, M. R. (2006). Chapter 11 Port Devolution and Governance in Canada. *Research in Transportation Economics*, *17*, 237–257. https://doi.org/10.1016/s0739-8859(06)17011-0

Brooks, M. R. (2017). A new direction or stay the course? Canada's port-specific challenges resulting from the port reform program of the 1990s. *Research in Transportation Business & Management*, *22*(C), 161–170. https://doi.org/10.1016/j.rtbm.2016.08.002

Brooks, M. R., & Cullinane, K. (2006a). Chapter 18 Governance Models Defined. *Research in Transportation Economics*, *17*, 405–435. https://doi.org/10.1016/s0739-8859(06)17018-3

Brooks, M. R., & Cullinane, K. (2006b). Chapter 18 Governance Models Defined. *Research in Transportation Economics*, *17*, 405–435. https://doi.org/10.1016/s0739-8859(06)17018-3

Brooks, M. R., Cullinane, K. P. B., & Pallis, A. A. (2017). Revisiting port governance and port reform: A multi-country examination. *Research in Transportation Business & Management*, *22*, 1–10. https://doi.org/10.1016/j.rtbm.2017.02.005

Brooks, M. R., & Pallis, A. A. (2008). Assessing port governance models: process and performance components. *Maritime Policy & Management*, *35*(4), 411–432. https://doi.org/10.1080/03088830802215060

Brooks, M. R., & Pallis, A. A. (2013). Editorial: Advances in port performance and strategy. *Research in Transportation Business & Management*, *8*(C), 1–6. https://doi.org/10.1016/j.rtbm.2013.09.002

Brooks, M. R., & Schellinck, T. (2014). Improving port effectiveness through determinance/performance gap analysis. *Maritime Policy & Management*, *41*(4), 328–345. https://doi.org/10.1080/03088839.2013.809632

Brooks, M. R., Schellinck, T., & Pallis, A. A. (2011). A systematic approach for evaluating port effectiveness. *Maritime Policy & Management*, *38*(3), 315–334. https://doi.org/10.1080/03088839.2011.572702

Cahoon, S., Pateman, H., & Chen, S.-L. (2013). Regional port authorities: leading players in innovation networks? *Journal of Transport Geography*, *27*(C), 66–75. https://doi.org/10.1016/j.jtrangeo.2012.06.015

Cariou, P., Ferrari, C., & Parola, F. (2015). Strategies in maritime and port logistics. *Maritime Economics & Logistics*, *17*(1), 1–8. https://doi.org/10.1057/mel.2014.30

Chandra, Y., Styles, C., & Wilkinson, I. (2009). The recognition of first time international entrepreneurial opportunities. *International Marketing Review*, *26*(1), 30–61. https://doi.org/10.1108/02651330910933195

Chang, & Talley. (2019). Port Competitiveness, Efficiency, and Supply Chains: A Literature Review. *Transportation Journal*, *58*(1), 1. https://doi.org/10.5325/transportationj.58.1.0001

Cui, H., & Notteboom, T. (2018). A game theoretical approach to the effects of port objective orientation and service differentiation on port authorities' willingness to cooperate. *Research in Transportation Business & Management*, *26*, 76–86. https://doi.org/10.1016/j.rtbm.2018.03.007

Cullinane, K., & Song, D.-W. (2001). The Administrative and Ownership Structure of Asian Container Ports. *International Journal of Maritime Economics*, *3*(2), 175–197. https://doi.org/10.1057/palgrave.ijme.9100013

Cullinane, K., Song, D.-W., & Gray, R. (2002). A stochastic frontier model of the efficiency of major container terminals in Asia: assessing the influence of administrative and ownership structures. *Transportation Research Part A: Policy and Practice*, *36*(8), 743–762. https://doi.org/10.1016/s0965-8564(01)00035-0

Cullinane, K., Teng, Y., & Wang, T.-F. (2005). Port competition between Shanghai and Ningbo. *Maritime Policy & Management*, *32*(4), 331–346. https://doi.org/10.1080/03088830500300438

D, G. K. P. (2017). How competition is driving change in port governance, strategic decision-making and government policy in the United States. *Research in Transportation Business & Management*, *22*(C), 67–77. https://doi.org/10.1016/j.rtbm.2016.08.003

Das, T. K., & Teng, B.-S. (2000). A resource-based theory of strategic alliances. *Journal of Management*, *26*(1), 31–61.

Debrie, J., Gouvernal, E., & Slack, B. (2007). Port devolution revisited: the case of regional ports and the role of lower tier governments. *Journal of Transport Geography*, *15*(6), 455–464. https://doi.org/10.1016/j.jtrangeo.2007.01.003

Debrie, J., Lacoste, R., & Magnan, M. (2017). From national reforms to local compromises: The evolution of France's model for port management, 2004–2015. *Research in Transportation Business & Management*, *22*, 114–122. https://doi.org/10.1016/j.rtbm.2016.12.006

Dooms, M., Haezendonck, E., & Valaert, T. (2013). Dynamic green portfolio analysis for inland ports: An empirical analysis on Western Europe. *Research in Transportation Business & Management*, *8*(C), 171–185. https://doi.org/10.1016/j.rtbm.2013.07.006

Ducruet, C., Lee, S.-W., & Ng, A. K. Y. (2010). Centrality and vulnerability in liner shipping networks: revisiting the Northeast Asian port hierarchy. *Maritime Policy & Management*, *37*(1), 17–36. https://doi.org/10.1080/03088830903461175

Ducruet, C., Rozenblat, C., & Zaidi, F. (2010). Ports in multi-level maritime networks: evidence from the Atlantic (1996–2006). *Journal of Transport Geography*, *18*(4), 508–518. https://doi.org/10.1016/j.jtrangeo.2010.03.005

Dyer, J. H., & Singh, H. (1998). The Relational View: Cooperative Strategy and Sources of Interorganizational Competitive Advantage. *Academy of Management Review*, *23*(4), 660–679. https://doi.org/10.5465/amr.1998.1255632

Eden, C., & Huxham, C. (1996). Action Research for Management Research. *British Journal of Management*, *7*(1), 75–86. https://doi.org/10.1111/j.1467-8551.1996.tb00107.x

Everett, S. (2007). Port reform in Australia: regulation constraints on efficiency. *Maritime Policy & Management*, *34*(2), 107–119. https://doi.org/10.1080/03088830701240086

Foss, N. J., Lyngsie, J., & Zahra, S. A. (2015). Organizational design correlates of entrepreneurship: The roles of decentralization and formalization for opportunity discovery and realization. *Strategic Organization*, *13*(1), 32–60. https://doi.org/10.1177/1476127014561944

Gaglio, C. M., & Katz, J. A. (2001). The Psychological Basis of Opportunity Identification: Entrepreneurial Alertness. *Small Business Economics*, *16*(2), 95–111. https://doi.org/10.1023/a:1011132102464

García, N., Adenso-Díaz, B., & Calzada-Infante, L. (2021). Identifying port maritime communities: application to the Spanish case. *European Transport Research Review*, *13*(1), 36. https://doi.org/10.1186/s12544-021-00495-1

Goss, R. O. (1986). Seaports should not be subsidized. *Maritime Policy & Management*, *13*(2), 83–104. https://doi.org/10.1080/03088838600000054

Granovetter, M. (1985). Economic Action and Social Structure: The Problem of Embeddedness. *American Journal of Sociology*, *91*(3), 481–510. https://doi.org/10.1086/228311

Granovetter, M. (1992). Economic institutions as social constructions: a framework for analysis. *Acta Sociologica*, *35*(1), 3–11.

Guo, L., Yang, D., & Yang, Z. (2018). Port integration method in multi-port regions (MPRs) based on the maximal social welfare of the external transport system. *Transportation Research Part A: Policy and Practice*, *110*, 243–257. https://doi.org/10.1016/j.tra.2017.09.008

Haezendonck, E., Verbeke, A., & Coeck, C. (2006). Strategic Positioning Analysis for Seaports. *Research in Transportation Economics*, *16*, 141–169. https://doi.org/10.1016/s0739-8859(06)16007-2

Håkansson, H., & Snehota, I. (1989). No business is an island: the network concept of business strategy. *Scandinavian Journal of Management*, *5*(3), 187–200.

Håkansson, H., & Waluszewski, A. (2013). A never ending story — Interaction patterns and economic development. *Industrial Marketing Management*, *42*(3), 443–454. https://doi.org/10.1016/j.indmarman.2013.02.010

Hall, P. V., & Olivier, D. (2007). Inter-firm relationships and shipping services: the case of car carriers and automobile importers to the United States. *Maritime Policy & Management*, *32*(3), 279–295. https://doi.org/10.1080/03088830500139836

Harrison, D., & Håkansson, H. (2006). Activation in resource networks: a comparative study of ports. *Journal of Business & Industrial Marketing*, *21*(4), 231–238. https://doi.org/10.1108/08858620610672597

Hayek, F. A. (1945). Time-Preference and Productivity: A Reconsideration. *Economica*, *12*(45), 22. https://doi.org/10.2307/2550247

Heaver, T, Meersman, H., Moglia, F., & Voorde, E. V. D. (2000). Do mergers and alliances influence European shipping and port competition? *Maritime Policy & Management*, *27*(4), 363–373. https://doi.org/10.1080/030888300416559

Heaver, T, Meersman, H., & Voorde, E. V. D. (2001). Co-operation and competition in international container transport: strategies for ports. *Maritime Policy & Management*, *28*(3), 293–305. https://doi.org/10.1080/03088830110055693

Heaver, Trevor. (2006). The Evolution and Challenges of Port Economics. *Research in Transportation Economics*, *16*, 11–41. https://doi.org/10.1016/s0739-8859(06)16002-3

Hitt, M. A., Ireland, R. D., Sirmon, D. G., & Trahms, C. A. (2001). Strategic Entrepreneurship: Creating Value for Individuals, Organizations, and Society. *SSRN Electronic Journal*, 1–20. https://doi.org/10.2139/ssrn.1994491

Hollen, R. M. A., Bosch, F. A. J. V. D., & Volberda, H. W. (2014). *Strategic levers of port authorities for industrial ecosystem development*. *17*(1), 79–96. https://doi.org/10.1057/mel.2014.28

Hong, P., Kwon, H. B., & Roh, J. J. (2009). Implementation of strategic green orientation in supply chain. *European Journal of Innovation Management*, *12*(4), 512–532. https://doi.org/10.1108/14601060910996945

Hoshino, H. (2010). Competition and Collaboration among Container Ports. *The Asian Journal of Shipping and Logistics*, *26*(1), 31–47. https://doi.org/10.1016/s2092-5212(10)80010-0

Hult, M., & Lennung, S. (1980). TOWARDS A DEFINITION OF ACTION RESEARCH: A NOTE AND BIBLIOGRAPHY. *Journal of Management Studies*, *17*(2), 241–250. https://doi.org/10.1111/j.1467-6486.1980.tb00087.x

I. K. (2007). *VAN NOSTRAND SERIES IN BUSINESS ADMINISTRATION AND ECONOMICS*. 1–338 1963,https://mises.org/sites/default/files/Market%20Theory%20and%20the%20Price%20System_2.pdf

Jacobs, W., & Hall, P. V. (2007). *What conditions supply chain strategies of ports? The case of Dubai*. *68*(4), 327–342.

Jansson, J. O., & Shneerson, D. (1982). *Port economics* (Vol. 8). MIT press.

Keh, H. T., Foo, M. D., & Lim, B. C. (2002). Opportunity Evaluation under Risky Conditions: The Cognitive Processes of Entrepreneurs. *Entrepreneurship Theory and Practice*, *27*(2), 125–148. https://doi.org/10.1111/1540-8520.00003

Kirzner, I. M. (1973). *Competition and Entrepreneurship*. https://doi.org/10.7208/chicago/9780226375489.001.0001

Kirzner, I. M. (2009). The alert and creative entrepreneur: a clarification. *Small Business Economics*, *32*(2), 145–152. https://doi.org/10.1007/s11187-008-9153-7

Kontinen, T., & Ojala, A. (2011). Network ties in the international opportunity recognition of family SMEs. *International Business Review*, *20*(4), 440–453. https://doi.org/10.1016/j.ibusrev.2010.08.002

Lam, J. S. L., & Yap, W. Y. (2011a). *Container port competition and complementarity in supply chain systems: Evidence from the Pearl River Delta*. *13*(2), 102–120. https://doi.org/10.1057/mel.2011.5

Lam, J. S. L., & Yap, W. Y. (2011b). Dynamics of liner shipping network and port connectivity in supply chain systems: analysis on East Asia. *Journal of Transport Geography*, *19*(6), 1272–1281. https://doi.org/10.1016/j.jtrangeo.2011.06.007

Langen, P. W. de. (2020). *Towards a Better Port Industry*. https://doi.org/10.4324/9780203797501

Langen, P. W. D., & Heij, C. (2014). Corporatisation and Performance: A Literature Review and an Analysis of the Performance Effects of the Corporatisation of Port of Rotterdam Authority. *Transport Reviews*, *34*(3), 396–414. https://doi.org/10.1080/01441647.2014.905650

Langen, P. W. D., & Lugt, L. M. V. der. (2006). Chapter 5 Governance Structures of Port Authorities in the Netherlands. *Research in Transportation Economics*, *17*, 109–137. https://doi.org/10.1016/s0739-8859(06)17005-5

Langen, P. W. D., & Lugt, L. M. V. der. (2017a). *Institutional reforms of port authorities in the Netherlands; the establishment of port development companies*.

Langen, P. W. D., & Lugt, L. M. V. der. (2017b). Institutional reforms of port authorities in the Netherlands; the establishment of port development companies. *Research in Transportation Business & Management*, *22*(C), 108–113. https://doi.org/10.1016/j.rtbm.2016.12.007

Lee, P. T.-W., & Lam, J. S. L. (2016). A review of port devolution and governance models with compound eyes approach. *Transport Reviews*, *37*(4), 1–14. https://doi.org/10.1080/01441647.2016.1254690

Lugt, L. V. der, Langen, P. D., & Hagdorn, L. (2015). Beyond the landlord: worldwide empirical analysis of port authority strategies. *International Journal of Shipping and Transport Logistics*, *7*(5), 570. https://doi.org/10.1504/ijstl.2015.072021

Lugt, L. van der, Dooms, M., & Parola, F. (2013). Strategy making by hybrid organizations: The case of the port authority. *Research in Transportation Business & Management*, *8*(C), 103–113. https://doi.org/10.1016/j.rtbm.2013.06.005

Lugt, L. M. van der, Langen, P. W. de, & Hagdorn, L. (2017). Strategic beliefs of port authorities. *Transport Reviews*, *37*(4), 412–441. https://doi.org/10.1080/01441647.2016.1245685

Ma, Q., Jia, P., She, X., Haralambides, H., & Kuang, H. (2021). Port integration and regional economic development: Lessons from China. *Transport Policy*, *110*, 430–439. https://doi.org/10.1016/j.tranpol.2021.06.019

Malchow, M. B., & Kanafani, A. (2004). A disaggregate analysis of port selection. *Transportation Research Part E: Logistics and Transportation Review*, *40*(4), 317–337. https://doi.org/10.1016/j.tre.2003.05.001

Marlow, P. B., & Casaca, A. C. P. (2003). Measuring lean ports performance. *International Journal of Transport Management*, *1*(4), 189–202. https://doi.org/10.1016/j.ijtm.2003.12.002

Martino, M. D., Carbone, V., & Morvillo, A. (2015). Value creation in the port: opening the boundaries to the market. *Maritime Policy & Management*, *42*(7), 682–698.

Martino, M. D., Errichiello, L., Marasco, A., & Morvillo, A. (2013). Logistics innovation in Seaports: An inter-organizational perspective. *Research in Transportation Business & Management*, *8*(C), 123–133. https://doi.org/10.1016/j.rtbm.2013.05.001

Martino, M. D., & Morvillo, A. (2008a). Activities, resources and inter-organizational relationships: key factors in port competitiveness. *Maritime Policy & Management*, *35*(6), 571–589.

Martino, M. D., & Morvillo, A. (2008b). Activities, resources and inter-organizational relationships: key factors in port competitiveness. *Maritime Policy & Management*, *35*(6), 571–589. https://doi.org/10.1080/03088830802469477

Martino, M. D., Morvillo, A., & Marasco, A. (2010). *Value Creation Within Port Supply Network: Methodological Issues*. 1–11. https://www.researchgate.net/profile/Marcella_De_Martino/publication/266216219_Value_Creation_Within_Port_Supply_Network_Methodological_Issues/links/54b90d830cf28faced6268ea.pdf

Merkel, A., & Sløk-Madsen, S. K. (2019a). Lessons from port sector regulatory reforms in Denmark: An analysis of port governance and institutional structure outcomes. *Transport Policy*, *78*, 31–41. https://doi.org/10.1016/j.tranpol.2019.03.010

Merkel, A., & Sløk-Madsen, S. K. (2019b). Lessons from port sector regulatory reforms in Denmark: An analysis of port governance and institutional structure outcomes. *Transport Policy*, *78*, 31–41. https://doi.org/10.1016/j.tranpol.2019.03.010

Metaxas, B. N. (1983). Maritime economics: Problems and challenges for the future. *Maritime Policy & Management*, *10*(3), 145–164. https://doi.org/10.1080/03088838300000028

Miles, M. B., & Huberman, M. A. (1994). *Qualitative data analysis: An expanded sourcebook*.

Notteboom, T. E., & Winkelmans, W. (2001a). Structural changes in logistics: how will port authorities face the challenge? *Maritime Policy & Management*, *28*(1), 71–89. https://doi.org/10.1080/03088830119197

Notteboom, T. E., & Winkelmans, W. (2001b). Reassessing Public Sector Involvement in European Seaports. *International Journal of Maritime Economics*, *3*(2), 242–259. https://doi.org/10.1057/palgrave.ijme.9100008

Notteboom, T., Knatz, G., & Parola, F. (2018). Port co-operation: types, drivers and impediments. *Research in Transportation Business & Management*, *26*, 1–4. https://doi.org/10.1016/j.rtbm.2018.04.004

Notteboom, T., & Rodrigue, J.-P. (2008). Containerisation, Box Logistics and Global Supply Chains: The Integration of Ports and Liner Shipping Networks. *Maritime Economics & Logistics*, *10*(1–2), 152–174. https://doi.org/10.1057/palgrave.mel.9100196

Oliveira, H. C. de, You, J., & Coelho, A. P. (2021). Governing coalitions and key performance indicators of port governance. *Maritime Transport Research*, *2*, 100023. https://doi.org/10.1016/j.martra.2021.100023

Pallis, A. A. (2006a). Chapter 7 Port Governance in Greece. *Research in Transportation Economics*, *17*, 155–169. https://doi.org/10.1016/s0739-8859(06)17007-9

Pallis, A. A. (2006b). Chapter 21 EU Port Policy: Implications for Port Governance in Europe. *Research in Transportation Economics*, *17*, 479–495. https://doi.org/10.1016/s0739-8859(06)17021-3

Pallis, A. A., & Syriopoulos, T. (2007). Port governance models: Financial evaluation of Greek port restructuring. *Transport Policy*, *14*(3), 232–246. https://doi.org/10.1016/j.tranpol.2007.03.002

Pallis, A. A., Vitsounis, T. K., & Langen, P. W. D. (2010). Port economics, policy and management: Review of an emerging research field. *Transport Reviews*, *30*(1), 115–161.

Panayides, P. M., & Cullinane, K. (2002). Competitive Advantage in Liner Shipping: A Review and Research Agenda. *International Journal of Maritime Economics*, *4*(3), 189–209. https://doi.org/10.1057/palgrave.ijme.9100045

Panayides, P. M., & Song, D.-W. (2013). Maritime logistics as an emerging discipline. *Maritime Policy & Management*, *40*(3), 295–308. https://doi.org/10.1080/03088839.2013.782942

Paré, G. (2004). Investigating Information Systems with Positivist Case Research. *Communications of the Association for Information Systems*, *13*. https://doi.org/10.17705/1cais.01318

Parola, F., Risitano, M., Ferretti, M., & Panetti, E. (2017). The drivers of port competitiveness: a critical review. *Transport Reviews*, *37*(1), 116–138. https://doi.org/10.1080/01441647.2016.1231232

Parola, F., Satta, G., Penco, L., & Profumo, G. (2013). Emerging Port Authority communication strategies: Assessing the determinants of disclosure in the annual report. *Research in Transportation Business & Management*, *8*(C), 134–147. https://doi.org/10.1016/j.rtbm.2013.04.005

Polidoro, F., Ahuja, G., & Mitchell, W. (2011). *When the social structure overshadows competitive incentives: The effects of network embeddedness on joint venture dissolution*. *54*(1), 203–223.

Ratajczak-Mrozek, M. (2017a). *Network Embeddedness, Examining the Effect on Business Performance and Internationalization*. https://doi.org/10.1007/978-3-319-56511-8

Ratajczak-Mrozek, M. (2017b). *Network Embeddedness, Examining the Effect on Business Performance and Internationalization*. 1–409. https://doi.org/10.1007/978-3-319-56511-8

Ritala, P., Golnam, A., & Wegmann, A. (2014). Coopetition-based business models: The case of Amazon.com. *Industrial Marketing Management*, *43*(2), 236–249. https://doi.org/10.1016/j.indmarman.2013.11.005

Ritter, T., Wilkinson, I. F., & Johnston, W. J. (2004). Managing in complex business networks. *Industrial Marketing Management*, *33*(3), 175–183. https://doi.org/10.1016/j.indmarman.2003.10.016

Robinson, R. (2017). Cooperation strategies in port-oriented bulk supply chains: aligning concept and practice. *International Journal of Logistics Research and Applications*, *18*(3), 193–206. https://doi.org/10.1080/13675567.2015.1026886

Rong, K., Hou, J., Shi, Y., & Lu, Q. (2010). From value chain, supply network, towards business ecosystem (BE): Evaluating the BE concept's implications to emerging industrial demand. *2010 IEEE International Conference on Industrial Engineering and Engineering Management*, 2173–2177. https://doi.org/10.1109/ieem.2010.5674561

Rozar, N. M., Sidik, M. H., Razik, M. A., Kamaruddin, S. A., Rozar, M. K. A. M., Usman, I., & Alown, B. E. (2022). A hierarchical cluster analysis of port performance in Malaysia. *Maritime Business Review*. https://doi.org/10.1108/mabr-07-2020-0040

Sarkis, J., Zhu, Q., & Lai, K. H. (2011). An organizational theoretic review of green supply chain management literature. *International Journal of Production Economics*, *130*(1), 1–15. https://doi.org/10.1016/j.ijpe.2010.11.010

Saz-Salazar, S. del, & García-Menéndez, L. (2015). Port expansion and negative externalities: a willingness to accept approach. *Maritime Policy & Management*, *43*(1), 59–83. https://doi.org/10.1080/03088839.2015.1032379

Schellinck, T., & Brooks, M. R. (2014). Improving port effectiveness through determinance/performance gap analysis. *Maritime Policy & Management*, *41*(4), 328–345.

Schumpeter, J. A., & Nichol, A. J. (1934). Robinson's Economics of Imperfect Competition. *Journal of Political Economy*, *42*(2), 249–259. https://doi.org/10.1086/254595

Sdoukopoulos, E., & Boile, M. (2020). Port-hinterland concept evolution: A critical review. *Journal of Transport Geography*, *86*, 102775. https://doi.org/10.1016/j.jtrangeo.2020.102775

Shane, Scott. (2000). Prior Knowledge and the Discovery of Entrepreneurial Opportunities. *Organization Science*, *11*(4), 448. JSTOR. http://www.jstor.org/stable/2640414

Shane, Scott, & Eckhardt, J. (2005). Handbook of Entrepreneurship Research, An Interdisciplinary Survey and Introduction. *International Handbook Series on Entrepreneurship*, 161–191. https://doi.org/10.1007/0-387-24519-7_8

Shane, SCOTT, & Venkataraman, S. (2000). The Promise of Entrepreneurship as a Field of Research. *Academy of Management Review*, *25*(1), 217–226. https://doi.org/10.5465/amr.2000.2791611

Shane, Scott, & Venkataraman, S. (2001). Entrepreneurship As a Field of Research: A Response to Zahra and Dess, Singh, and Erikson. *Academy of Management Review*, *26*(1), 13–16. https://doi.org/10.5465/amr.2001.27879269

Shane, Scott, Venkataraman, S., & MacMillan, I. (1995). Cultural differences in innovation championing strategies. *Journal of Management*, *21*(5), 931–952. https://doi.org/10.1016/0149-2063(95)90048-9

Slack, B., & Frémont, A. (2005). Transformation of port terminal operations: from the local to the global. *Transport Reviews*, *25*(1), 117–130. https://doi.org/10.1080/0144164042000206051

Song, D.-P., Lyons, A., Li, D., & Sharifi, H. (2016). *Modeling port competition from a transport chain perspective*. 1–22. https://doi.org/10.1016/j.tre.2016.01.001

Song, D.-W. (2002). Regional container port competition and co-operation: the case of Hong Kong and South China. *Journal of Transport Geography*, *10*(2), 99–110. https://doi.org/10.1016/s0966-6923(02)00003-0

Song, D.-W. (2010). Port co-opetition in concept and practice. *Maritime Policy & Management*, *30*(1), 29–44. https://doi.org/10.1080/0308883032000051612

Song, D.-W., Cheon, S., & Pire, C. (2015). *Does size matter for port coopetition strategy? Concept, motivation and implication*. 1–22. https://doi.org/10.1080/13675567.2015.1032229

Song, D.-W., & Lee, S.-W. (2017). Port governance in Korea: Revisited. *Research in Transportation Business & Management*, *22*, 27–37. https://doi.org/10.1016/j.rtbm.2016.11.002

Song, D.-W., & Panayides, P. M. (2008). Global supply chain and port/terminal: integration and competitiveness. *Maritime Policy & Management*, *35*(1), 73–87. https://doi.org/10.1080/03088830701848953

Talley, W. K., Ng, M., & Marsillac, E. (2014). Port service chains and port performance evaluation. *Transportation Research Part E*, *69*(C), 236–247. https://doi.org/10.1016/j.tre.2014.05.008

Tang, J., Levasseur, L., Karami, M., & Busenitz, L. (2021). Being alert to new opportunities: It is a matter of time. *Journal of Business Venturing Insights*, *15*, e00232. https://doi.org/10.1016/j.jbvi.2021.e00232

Tijan, E., Jović, M., Panjako, A., & Žgaljić, D. (2021). The Role of Port Authority in Port Governance and Port Community System Implementation. *Sustainability*, *13*(5), 2795. https://doi.org/10.3390/su13052795

Trujillo, L., Campos, J., & Pérez, I. (2018). Competition vs. cooperation between neighbouring ports: A case study in Chile. *Research in Transportation Business & Management*, *26*, 100–108. https://doi.org/10.1016/j.rtbm.2018.03.005

Tsiulin, S., & Reinau, K. H. (2021). The Role of Port Authority in New Blockchain Scenarios for Maritime Port Management: The Case of Denmark. *Transportation Research Procedia*, *52*, 388–395. https://doi.org/10.1016/j.trpro.2021.01.045

Vaggelas, George K. (2019). Measurement of port performance from users' perspective. *Maritime Business Review*, *4*(2), 130–150.

Vaggelas, Georgios K, & Pallis, A. A. (2010). Passenger ports: services provision and their benefits. *Maritime Policy & Management*, *37*(1), 73–89. https://doi.org/10.1080/03088830903461209

Vanelslander, T. (2015). Value creation in the port and shipping business: selected cases from the Rio WCTR 2013 conference. *Maritime Policy & Management*, *42*(7), 633–635. https://doi.org/10.1080/03088839.2015.1076925

Verhoeven, P. (2010). A review of port authority functions: towards a renaissance? *Maritime Policy & Management*, *37*(3), 247–270. https://doi.org/10.1080/03088831003700645

Verhoeven, P., & Vanoutrive, T. (2012). *A quantitative analysis of European port governance*. *14*(2), 178–203. https://doi.org/10.1057/mel.2012.6

Vieira, G. B. B., Neto, F. J. K., & Amaral, F. G. (2014). Governance, Governance Models and Port Performance: A Systematic Review. *Transport Reviews*, *34*(5), 645–662. https://doi.org/10.1080/01441647.2014.946458

Vieira, G. B. B., Silva, R. M. da, Neto, F. J. K., Senna, L. A. dos S., & Mulinas, A. M. (2014). Port Governance Model by Managers' and Customers' Point of View: A Study at Port of Valencia, Spain. *International Business Research*, *7*(8), 1–16. https://doi.org/10.5539/ibr.v7n8p1

Wang, P., & Mileski, J. (2018). Strategic maritime management as a new emerging field in maritime studies. *Maritime Business Review*, *3*(3), 290–313. https://doi.org/10.1108/mabr-06-2018-0019

Wiegmans, B. W., Hoest, A. V. D., & Notteboom, T. E. (2008). Port and terminal selection by deep-sea container operators. *Maritime Policy & Management*, *35*(6), 517–534. https://doi.org/10.1080/03088830802469329

Wilhelm, M. M. (2011). Managing coopetition through horizontal supply chain relations: Linking dyadic and network levels of analysis. *Journal of Operations Management*, *29*(7–8), 663–676. https://doi.org/10.1016/j.jom.2011.03.003

Woo, S.-H., Pettit, S., & Beresford, A. K. C. (2011). *Port evolution and performance in changing logistics environments*. *13*(3), 250–277. https://doi.org/10.1057/mel.2011.12

Woo, S.-H., Pettit, S. J., Kwak, D.-W., & Beresford, A. K. C. (2011). Seaport research: A structured literature review on methodological issues since the 1980s. *Transportation Research Part A*, *45*(7), 667–685. https://doi.org/10.1016/j.tra.2011.04.014

Yap, W. Y., & Lam, J. S. L. (2006). Competition dynamics between container ports in East Asia. *Transportation Research Part A: Policy and Practice*, *40*(1), 35–51. https://doi.org/10.1016/j.tra.2005.03.001

Yeo, G.-T., & Song, D.-W. (2006). An Application of the Hierarchical Fuzzy Process to Container Port Competition: Policy and Strategic Implications. *Transportation*, *33*(4), 409–422. https://doi.org/10.1007/s11116-005-6000-4

Yin. (2003). *Case Study Research Design and Methods.* 3rd Edition, Sage, Thousand Oaks. https://www.scirp.org/(S(lz5mqp453edsnp55rrgjct55))/reference/ReferencesPapers.aspx?ReferenceID=1994558

Zhang, Q., Geerlings, H., Makhloufi, A. E., & Chen, S. (2018a). Who governs and what is governed in port governance: A review study. *Transport Policy*, *64*, 51–60. https://doi.org/10.1016/j.tranpol.2018.01.019

Zhang, Q., Geerlings, H., Makhloufi, A. E., & Chen, S. (2018b). Who governs and what is governed in port governance: A review study. *Transport Policy*, *64*, 51–60. https://doi.org/10.1016/j.tranpol.2018.01.019

Zhang, Q., Zheng, S., Geerlings, H., & Makhloufi, A. E. (2019). Port governance revisited_ How to govern and for what purpose? *Transport Policy*, *77*, 46–57. https://doi.org/10.1016/j.tranpol.2019.03.001

Zheng, S., & Luo, M. (2021). Competition or cooperation? Ports' strategies and welfare analysis facing shipping alliances. *Transportation Research Part E: Logistics and Transportation Review*, *153*, 102429. https://doi.org/10.1016/j.tre.2021.102429

ENTREPRENEURIAL ZEALOUSNESS IN COOPETITION PORT AUTHORITY STRATEGY: OPPORTUNITY RECOGNISTION FRAMEWORK

1.ABSTRACT

PURPOSE

In recent years, many scholars have emphasised the importance of recognising the value of entrepreneurship in port-specific research. However, the synthesis of port-related literature with the field of entrepreneurship has not yet resulted in any significant dialogue. This paper aims to begin such a dialogue about entrepreneurship alertness through the Entrepreneurship Opportunity Recognition (EOR) process, which is considered to be one of the key elements of the entrepreneurship literature. One of the justifications for this delay relates to the port ownership of municipal ports and the complex division of the responsibilities of port authorities in different ports across Europe. This said, in recent times, the European Sea Ports Organization (ESPO) has realised that to create better strategies it is essential for port authorities to be granted autonomy to investigate a new wave of entrepreneurial alertness. This can be seen in the newly-reformed public limited liability port authorities which have contributed to the new wave of proactive, risky and innovative strategies.

DESIGN/ METHODOLOGY

This paper's scope lies within the boundary of port authority strategies to understand and investigate the concept of entrepreneurial alertness introduced by Kirzner (1979). To accomplish this, this paper presents a conceptual framework that will assist port authorities to optimally utilise the land acquired through the merger of different land coopetition under one cooperative port authority. This framework takes entrepreneurial antecedents into consideration, within which the opportunity recognition (OR) process is broken down. It explains the need to implement this process in order to cultivate entrepreneurial alertness in port authority strategy. This process is structured as an input-process-outcome model within which the input includes the port authority structure, which is used to develop strategies. This process is adopted from the views of Sarasvathy et al. (2003) and Ardichvili et al. (2003) concerning opportunity identification. The output demonstrates that the port authority strategy outcome is to research the ability to seek the value needed by the market.

FINDINGS

To analyse this framework, the study interviewed three port authorities which display cooperative strategies: the Port of Haminakotka (Finland); the Port of Kvarken (Sweden); and the Associated Danish Ports (Denmark). The findings of this paper provide insights on the antecedents of recognising opportunity that exists in these coopetition ports. The paper presents the concept of entrepreneurial zealousness, with behaviours of openness to experience, taking the initiative of deliberate searching, autonomy to get access to knowledge and to be able to interact with customers, interpersonal trust, recognising their customers' problems through 'search scanning', and being open-

minded enough to provide transparent, no-cost solutions to their customers. These antecedents have the potential for creating value for both port customers and coopetition port authorities. In addition, this research stream also contributes the point that the antecedents of absence of entrepreneurial zealousness, credibility and leadership are the main catalyst for value void.

VALUE OF THE PAPER

The contribution made by this study is that value sought was achieved successfully by the port authorities, thereby showing entrepreneurial zealousness as well as alertness in their process of opportunity recognition. This means that they were able to undertake market needs through value sought, and that to create value sought they needed resources to address this need. Novel strategies were developed to study the new phenomenon of digitalisation in both the Port of Haminakotka and the Associated Danish Ports. However, although the Port of Kvarken reflected some strategies that were value void, they seemed to lack the entrepreneurial zealousness for these strategies to be successfully implemented, and for the strategies to be executed.

2. INTRODUCTION

Research into port authorities has been conducted in a wide range of different fields, including terminal studies, ports in the transport and supply chain, port governance, and port and spatial analysis to name but a few (T. E. Notteboom et al., 2013; Pallis et al., 2011; Panayides & Song, 2013; Woo et al., 2012). To date, port governance discipline appears to be the most promising and emergent topic (Panayides & Song, 2013; Vieira et al., 2014), wherein port development projects have been studied through an institutional lens but have not yet investigated from the perspective of business development and strategies. Similarly, there has been some research which has introduced port authorities as being coopetition port authorities, as organisational firms, as international strategic firms or, in some scenarios, as multinational enterprises (L. V. der Lugt et al., 2015; D.-W. Song, 2010). The reason for the change in perception of various authors towards a new entrepreneurial port authority is due to the recognition of characteristics of a general organisational structure, autonomy (to a certain extent) and the existence of entrepreneurial strategies. These resonating characteristics of a business entity show that ports can follow market changes and keep on the same track as their customers' business development whilst simultaneously learning from the market.

An example of this are the Nordic port authorities, which are now being more environmentally conscious. They are implementing changes to not only comply with regional government directives, but also to improve their competitiveness and performance through their own innovation. A further example is the Port of Esbjerg, which focuses on the digitalisation of the port call optimisation process through the online 'one platform, one decision' system, where information can be shared in order to maintain sustainable shipping. Similarly, the Port Authority of Antwerp has invested in green technology, providing an "environmental discount" of up to 20% for ships that meet certain conditions. The Port of Rotterdam is focusing on energy transition strategies by monitoring CO_2 emissions through their port call optimisation platform. To date, however, there has been no framework in the literature as to how these port authorities can develop an entrepreneurial mindset, and whether that can be replicated in other port authorities.

In a similar vein, previous studies have discussed the position of port authorities according to their functions and responsibilities (Goss, 1990a, 1990b, 1990c), descriptions of various port policies and governance (Brooks & Cullinane, 2006), and indicators of port performance (Tull & Reveley, 2008) amongst others. This paper presents a new way of understanding the port authority as a 'firm' that is imbued with the essence of innovation, risk-tasking and pro-activeness. From the ownership perspective, the 'firm' also governs one – or more than one – port. One such example is the Copenhagen Malmö Port, which set a trend for the phenomenon of coopetition ports. Historically, it has been suggested that port authorities be analysed as 'firms' by presenting port authority typologies (e.g. landlord) and by remaining true to the port-related literature, which delineates the different functions of port authorities through different attitudes (L. V. der Lugt et al., 2015). However, little research has been done on the antecedents that result in changes from an authoritative mindset to a 'firm-like' attitude. This paper agrees with those researchers in attempting to specifically investigate the entrepreneurial alertness of the port authority (P. W. D. Langen & Heij, 2014; L. van der Lugt et al., 2013; T. E. Notteboom & Winkelmans, 2001a; Robinson, 2002; Verhoeven, 2010).

The term 'entrepreneurial alertness' was proposed by Kirzner (1973) to explain the concept of entrepreneurial recognition of opportunity(Kirzner, 1973). Similarly, it was explained that recognition of opportunity was generally preceded by an awareness of alertness held by a prospective entrepreneur towards opportunity (Ardichvili et al., 2003). Furthermore, Ray and Cardozo (1996) defined entrepreneurial alertness as a kind of entrepreneurial awareness in which there is "a propensity to notice and be sensitive to information about objects, incidents and patterns of behaviour in the environment, with special sensitivity to maker and user problems, unmet needs and interests, and novel combinations of resources" (Ardichvili et al., 2003: 6). Following this line of thought, alertness increases the chances of recognising opportunity. However, there has been little empirical indication about how alertness could be measured, an aspect which researchers need to address in the future.

This paper is heavily influenced by (Verhoeven, 2010) and (L. V. der Lugt et al., 2015) in answering the question as to how ports which display coopetition can recognise opportunities to creates 'business-like strategies. In answering this question, the following are investigated: What are the 'critical factors' for ports which display coopetition to recognise entrepreneurial opportunities? What are the 'antecedents' in opportunity recognition that drive the port displaying coopetition to ultimately create value? What are the 'antecedents' which the port displaying coopetition needs in order to avoid a value-void outcome or to create new opportunities? Two further questions which will be addressed are: In what way have port authorities evolved from being a government institution to becoming a 'firm-like' business that aims to create value sought through their entrepreneurial nature, and what is the impact of the port authority management's strategies on entrepreneurial alertness.

Section (6) presents a conceptual model which analyses the antecedents of entrepreneurial alertness. The nodes are derived from the literature review focusing on 'opportunity recognition', and will be utilised to find the antecedents of entrepreneurial alertness. The conceptual model adopts the structure of an input-process-output model in order to create a port authority strategy containing an entrepreneurial opportunity identification (EOI) process in which there is a value sought output (and eventually value creation). To ensure that this paper continues along similar lines, it focuses on the strategies gathered via the case study method whilst also providing a new perspective which includes an attitude of pro-activeness, innovativeness and risk-taking ability. Through this, it attempts to answer the question of how port authorities can be studied and understood in different ways.

Considering the context, the current study analyses the coopetition port strategies of the Port of Haminakotka, the Port of Kverken and the Associated Danish Ports. A conceptual model is presented which analyses the antecedents of entrepreneurial alertness. To achieve the research objective of this study, the following specific activities were undertaken: (1) the conceptual framework of opportunity recognition is applied to strategies to identify 'critical factors' for PA displaying coopetition to recognise opportunities; (2) the conceptual framework applied contributes to the 'antecedents' required by managerially cooperative port authorities to create value; (3) the conceptual framework also presented the 'antecedents' needed to avoid value-void outcomes and to create new opportunities.

In the following section (2), the definition of 'port authority' adopted is defined and outlined. In section (2.2), the typologies that exist in the port authority literature are examined, paying particular attention to the entrepreneurial typology of the port authority literature and explaining the context. In section (3.2), the unit of analysis in the port authority strategies literature is explained, with the intention of taking guidance in selecting the strategies for our in-depth case study. Section (4) then adopts the lens of opportunity recognition to help us thoroughly investigate our research objectives.

2.1. DEFINITION OF PORT AUTHORITY

The European Commission has defined a port authority as follows: "the entity which, whether or not in conjunction with other activities, has as its objective under national law or regulation the administration and management of the port infrastructures, and the co-ordination and control of the activities of the different operators present in the port" (Commission of the European Communities, 2001; Verhoeven, 2010: 15). Most researchers have adopted this definition of port authorities, as landlord ports working under a regulatory function. This said, other functions have also been identified, including those based on management aspirations, community demands and the port size. The role of the port authority is more of a public body with a defined jurisdiction, but in the literature it is presented as something more interchangeable with management and role. Larger ports tend to be divided into a port authority and commercial department. These divisions are generally clear, with their functions not being interchangeable. The Port of Rotterdam, for example, has a harbour master division that manages the waterside port call and its inspection function, whereas the commercial side of the port focuses on community customer value. Small and medium-sized ports tend to have a more interchangeable or single management division containing both the harbour master and commercial managers. The particular focus of this paper is on medium-sized ports, and the term 'port authority' is used interchangeably to include both the harbour master and commercial managers. The data collected in this paper suggests that the port authority's role should be considered according to several different dimensions, and should not be restricted to just its authority function. Therefore, this paper examines both the authority function of cooperative ports as well as their activities.

2.2. TYPOLOGIES OF PORT AUTHORITY

Early studies on port management models were concerned only with detailing and distinguishing the functions of each existing port type. The World Bank (2001), responsible for the initial classification of port management models, indicates the existence of four factors that influence how ports are organised: the socioeconomic structure of the country; its historical development; the location of the port; the type of cargo handled. Driven by these factors, World Bank (2001) presents four different port administration models: public service ports; tool ports; landlord ports; private service ports. Based on these concepts, global port research demonstrates not only the evolution of port logistics chains, but also the need to improve them. This fact is closely linked to governance practices.

There are three significant milestones with respect to discussing the role of port authorities. The first, a series of four papers by Gross (1990), presents arguments on the contributions of public port authorities to private sector efficiency, provides an analysis of the economic function of the port, examines various strategic positions based on local to global competition, and investigates how different forms of control influenced different policies. The second is the research by (Heaver et al., 2000), which explains that the role of the port authorities was influenced by their ownership structure, meaning that a public port was concerned with maximising trade and infrastructure investment whereas the aim of private ports was to maximise market share. The third paper, by (Verhoeven, 2010) combines port function with the geographical dimension in a matrix that presents the possibility of a port authority typology.

This paper highlighted three different typologies. Conservator port authorities are defined as low-profile ports that undertake three traditional port authority functions at local level. This type of port tends to exist in port authorities that focus on their traditional landlord duties and/or their role as a regulator within the community. This paper believes that if landlord ports are only performing their traditional role, it is likely that they will become extinct in the current digital age. It is recommended that landlord ports which are conservatory in nature should try and transition to a facilitator role in order to increase the business in their port boundaries. Facilitator-type ports are more focused on local regional markets. They are more of a mediator for the community and have more overview of the hinterland connection to ports. They play a role in strategic regional partnerships, and are the most studied type in port authority literature. Entrepreneur port authorities are a combination of various mindsets. As facilitators with a service-oriented profile, they offer greater innovativeness in infrastructure investment, and are more closely aligned with risk, meaning that they have a learning and testing mentality with problems. This can create conflict with established port governance, resulting in a lack of autonomy due to its non-complementary ownership structure. Coopetition ports have started using multiple ports under one port authority, which affords the opportunity to be innovative with their land use.

In summary, both ownership and strategy should be considered in tandem when describing the unique typology of port authorities. This paper concentrates on port authorities which embody the entrepreneurial characteristics of their function, by which we mean that ports which embody innovativeness through their resource utilisation and organisational proactiveness, and who can compete competitively through collaboration despite the risk and uncertainty in their environmental strategy. For this paper, we select the strategies of coopetition ports (D.-W. Song, 2010) as our unit of analysis since they focus specifically on port authorities.

3. LITERATURE REVIEW

3.1. PORT AUTHORITIES STRATEGIES

The current literature shows that there have been several attempts to classify or identify the port strategies undertaken by port authorities through conceptualised studies (Baltazar & Brooks, 2006; Goss, 1990a; Heaver et al., 2001; L. M. van der Lugt et al., 2017; T. Notteboom, 2006; Slack et al., 2002; Verhoeven, 2010; J. J. Wang et al., 2004). Some of these strategies indicate the essence of opportunity recognition (Ardichvili et al., 2003) by adopting attitudes such as: entrepreneurial alertness; information asymmetry and prior knowledge; social networks; personality traits, including optimism, self-efficacy, and creativity; and the type of opportunity itself. Similarly, an alternative perspective for port authority cognition was introduced as a new approach for measuring strategy (L. M. van der Lugt et al., 2017). Currently port authorities are transitioning from a landlord mentality to a corporate or commercial mentality while communicating and managing these changes to their customers and port service providers (L. van der Lugt et al., 2013). Similarly, an empirical study was undertaken by van der Lugt et al. (2015) that stated that the transition of port strategy had gone beyond landlord ports.

In addition, current port reform is providing ports with the opportunity to build alliances and to collaborate with the essence of entrepreneurial strategy (Dooms, Verbeke, et al., 2013; Verhoeven, 2010). In the section below, the various opportunities that were translated as 'business-like strategies' in the port authority literature are consolidated. Such strategies include: strategies that promote business relationships with other actors in the supply chain (P. W. D. Langen, 2006); strategies that encourage port authorities to go beyond the jurisdiction of the ports, and to display interest in hinterland strategies (Berg & Langen, 2011; Horst & Langen, 2008; L. van der Lugt et al., 2013; L. M. van der Lugt et al., 2017); strategies that adopt the knowledge sharing and learning processes of ports; strategies which leave the physical boundaries of port authorities and invest in overseas involvement and joint projects (P. W. D. Langen, 2005; Verhoeven, 2010); proactive environmental strategies that affect and influence the function of port authorities (Coto-Millán et al., 2016; Psaraftis & Pallis, 2012); strategies which develop safety and security, and which consider not only the actors in the port jurisdiction but also the community that surrounds the geographical location (Bichou & Gray, 2004; Ferrari et al., 2011; Talley, 2009); and finally strategies that, through communication and transparency, involve other actors and enable better interaction with port actors (Cahoon et al., 2013).

Van den Berg and De Langen (2011) present several examples of conflict which typically occur in the development strategies of port authorities. This paper follows Van den Berg and De Langen (2011) in arguing that it is important to consider port actors when port authorities' business development strategies are created(Berg & Langen, 2011). This paper is especially interested in cases that consider the context of entrepreneurial strategies because most port authorities which have a proactive and risk-taking nature have focused on innovative, dynamic contexts. This has been from both the overall

perspective of port performance strategies as well as port authority revenue through traffic flow. Moreover, by applying sustainability arguments, it is crucial that traffic not only addresses the unavoidable challenge of congestion but also creates opportunities for the more effective use of existing port capacities. This is an issue which has become extremely topical due to the economic crisis. As argued by Verhoeven (2010: 258), "Port authorities can develop an entrepreneurial role in this respect by making direct investments in the hinterland or play a facilitating role through the development of strategic partnerships with inland ports, dry ports and coopetition or through 'co-opetition' with other, neighbouring, seaports."
In a similar context, port authority strategies have recently been viewed as proactively expanding their scope beyond their immediate geographical area. One example of this arises from the increased traffic and congestion challenges faced by ports, resulting in port authorities privately developing strategies which attract traffic to the port, but which also provide a smooth connectivity to the hinterland. This has the effect of reducing congestion. For instance, the research done by van den Berg et al. (2012) stated that Barcelona decided to invest in strategies that connected it to the hinterland by building a shuttle to connect the city to Lyon, thereby increasing accessibility (Berg et al., 2012). However, these strategies cannot be developed or adopted in isolation. Other actors have to be considered while undertaking the role of creating and implementing strategies, especially in cases where the involvement of port service providers such as agents or freight forwarders is required. Similarly, it is important to state that the involvement of both port users (vessel operators, surveyors, truck operators, associations) and port service providers (agents, freight forwarders, stevedores, pilots) is necessary when the coopetition port develops their strategies, so that port service providers and port users (e.g. associations) located within and around the port "can contribute most to a competitive and sustainable development of the port" (van der Lugt et al., 2013: 111).

This said, most port authorities tend to overlook their key role in 'influencing' their customers, who have sometimes been subconsciously misinterpreted. This lack of consideration of influencers in developing strategies eventually leads to problems when the strategies are implemented. This role has been underexplored in the port-related literature (Hollen et al., 2014), wherein most of the port strategies overlook the stakeholders located in the port area. Actors such as agents, carriers, terminal operators, and logistics operators recognise, through their power and ties, that large firm actors have only limited ties or interests in port strategies where innovativeness is concerned. As such, this eventually leads to less proactivity, competition and traffic flow. Furthermore, if port authorities lack affinity with local communities, or do not consider the cultural difference between the coopetition ports and local actors and the societal dimension created by the conflict of intent with various port actors, friction within their strategies may develop.

In a similar vein, if conserving the entrepreneurial strategy context of the port authority, it is necessary to consider externalities that are present within and around their jurisdiction (Dooms, Verbeke, et al., 2013). One such externality that should be considered are port actors. Port actors have been viewed as stakeholders in the supply chain who can work together with the port authority to maintain sustainability in the port (Denktas-Sakar & Karatas-Cetin, 2013). Similarly, Hall and Jacobs (2009) identify that port authorities should consider their position from the organizational perspective of port actors who can support their future economic growth(Hall & Jacobs, 2009). The key point here is that port actors are crucial for business opportunities. Notwithstanding the many and varied definitions of stakeholder and port customers which have been advanced, no universally agreed definition for these groups has yet emerged. It is therefore important to provide a simplified boundary stating that the term 'port actors' is challenging in port-specific research, especially when the importance or relevance of the term changes per the needs of the market. Specific focus should be given to understanding the value or stake of the various port actors in order to measure performance with regards to the objectives of different port actors (T. E. Notteboom & Winkelmans, 2001a, 2001b).

Furthermore, the objectives or ideals of port actors are commonly diverse and conflicting. Even within a group of port actors there may well be conflict between individual entities in terms of the group objectives (Hill & Jones, 1992) This paper defines and classifies various port actors according to the three layers of the port authority, the port user and the port service provider. The port user consists of the end business owner, terminals, carriers (vessel operators) and their representatives. The port service provider consists of agents, stevedores, port control, linemen, tugs, and pilots.

This paper argues that these arguments can be clearly justified because the port actor concept, as illustrated above, has been developed to categorise port users and port service providers under one umbrella. This will help us find consensus for our research objective. Other specific organisations were also included in the discussion (e.g. public bodies and not-for-profit organisations). The concept of port actors' entrepreneurial involvement with coopetition ports has appeared only recently in academic discussions (Huo et al., 2018; Trujillo et al., 2018) as port function. Wang and Mileski (2018) suggests that port strategy literature is moving towards a level of maturity where research of port coopetition (Song and Parola, 2015) will contribute to the theoretical implications that explain the evolution of port strategy between business strategy and operational strategy (Dinwoodie et al., 2011; Guo et al., 2021; Ng & Pallis, 2010; D.-W. Song & Parola, 2015; P. Wang & Mileski, 2018). In summary, this paper suggests that the port coopetition literature demonstrates the potential for study from an entrepreneurial perspective.

3.2. UNIT OF ANALYSIS: COOPETITION PORTS

The term 'co-opetition' itself was introduced by Song (2002), and the volume of the 'co-opetition' ports literature has increased considerably in the maritime field in recent years(T. E. Notteboom, 2003; D.-P. Song et al., 2016; D.-W. Song, 2010; D.-W. Song et al., 2015; Stamatović et al., 2018; Trujillo et al., 2018; P. Wang & Mileski, 2018). Song (2002) argues that ports should merge their competences, governance and geographic advantages through cooperation to attract more business rather than compete against each other. 'Proximity of the ports' was a key element that initiated the conversation of coopetition within Copenhagen Malmo Port (D. Langen & Nijdam, 2009). Similarly, the case study of coopetition between Long Beach and Los Angeles provides another example of creating value by merging and managing congestion in the hinterland to provide a strong front against competition (JACOBS, 2007). This started a conversation in the research community where ports were being advised to merge to access the benefits of port coopetition (Hoshino, 2010). In contrast, port authorities have limited legal authority to innovate, so commercial ports strive to compete against other ports (K. Wang et al., 2012). This has also been encouraged by shipping lines and agents for receiving the competitive costs on port dues. However, this paper argues that coopetition of port authorities contributes to advantages that go far beyond cost, Providing the whole logistical chain the opportunity to achieve greater efficiency (D. Langen & Nijdam, 2009). As such, we argue the coopetition of port authority contributes to the future maturity of port authority strategies.

In terms of the applicability of coopetition, Russo and Musolino, (2021) delineated different types of coopetition, namely coopetition of port authorities in close proximity by merging under one management system, coopetition in port authorities to capture multiple or single market segments, and coopetition based on infrastructure projects (Russo & Musolino, 2021). Furthermore, three levels of category were identified as: the merging of strategy of two different ports under one umbrella and one management; the essence of cooperation between ports but not at the strategic level; and where port authorities have no intention to cooperate even though they are in close proximity, are part of the same network, and are members of the same associations. The evolution of cooperation may be based on the need to survive and evade unnecessary competition, or else it may be that ports have a common portfolio and are situated on the same route, or that they have different profiles, which means they can merge strategically or temporally on a particular project (Fremont & Lavaud-Letilleul., 2009).

As noted above, there has been a realisation about the importance of a conceptual framework which can be implemented in a case-specific region (Huo et al., 2018; D.-W. Song, 2010; Trujillo et al., 2018; K. Wang et al., 2012). However, limited research has been done on understanding the antecedents of the management of port coopetition strategies. Deconstructing the processes of recognising these strategies would shed more light on the successes achieved by these ports as well as contributing to the theoretical framework needed for this mature topic(P. Wang & Mileski, 2018). This paper also examines those strategies which are not as successful, identifying the key learning points from them. The existing research framework is limited, allowing us the opportunity to propose a framework that explains how entrepreneurial strategies are constructed and recognised in coopetition ports.

As stated above, this paper tries to include different actors and coopetition port authorities from the Nordic region (Denmark, Finland and Sweden) in order to build a foundation that expresses the innovative, proactive and risk-taking entrepreneurial alertness of port authorities at the managerial level. On the basis of the above literature review, this paper contributes to a framework focused on the strategic planning of Nordic cooperative ports. This framework is input-process-output in nature, and there is an additional element of opportunity recognition that incorporates cooperative port strategy as an entity that can identify entrepreneurial opportunity as value sought or value void. This paper aims to study value creation when Nordic coopetition ports move beyond the jurisdiction of their location, and when their strategies go beyond the boundaries of their traditional function. This paper presents a conceptual framework for an empirical research agenda, which will be implemented in two steps. First, it will present an investigation into the application of the opportunity recognition to the coopetition component of port strategies. Second, it will use an input-process-output model analysis of the influence of the entrepreneurial opportunity to create value for the port business development.

4. THEORY

4.1.OPPORTUNITY RECOGNITION

There have been many views expressed regarding entrepreneurial opportunity recognition. This fact is acknowledged by this paper. In order to build a link between the port authority and entrepreneurship, it is necessary to understand Schumpeter (1934), Hayek (1945) and Kirzner (1973), whose views reveal and recognise different images of opportunity(Hayek, 1945; Kirzner, 1973; Schumpeter & Nichol, 1934). Although this theory has evolved over time, Schumpeter's (1934) central idea remains that of the 'creative destruction' process – a process which occurs when new opportunities displace existing business models. Kirzner's approach, meanwhile, suggests the discovery process of opportunity, which is concluded with an assessment of risk and uncertainty. Shane and Venkataraman (2000: 218) offer a more expansive definition, saying that the "field of entrepreneurship [is] the scholarly examination of how, by whom, and with what effects opportunities to create future goods and services are discovered, evaluated, and exploited" (Hitt et al., 2001). They further argue that entrepreneurship involves factors such as sources of opportunities, the processes of discovery, evaluation and the exploitation of opportunities, and the set of individuals who discover, evaluate and exploit opportunities. Consistent with this definition, Hitt et al. (2001: 480) define entrepreneurship as "the identification and exploitation of previously unexploited opportunities." Ireland et al. (2001: 51) expanded this definition to include a focus on wealth creation as an outcome of entrepreneurship – a definition which resonates with the nature of port authorities(Hitt et al., 2001; Ireland et al., 2001).

Given all this, this paper offers the contribution that an opportunity is only valid as an opportunity until it is identified by competitors. Furthermore, this study accepts that in order to understand value sought, it is essential to consider the views of Sarasvathy et. al (2003) on entrepreneurial opportunities, within which the entrepreneurial recognition framework is discovered, evaluated and exploited. In addition, it is realised that initial stage recognition can be understood by different processes of creation or discovery or identification. As such, in order to argue that entrepreneurial alertness exists in coopetition ports, it is essential to consider the factors that influence entrepreneurial opportunity recognition for these ports. To achieve this, Ardichvili et al. (2003) suggest that the major factors influencing the core process of opportunity is entrepreneurial alertness, along with prior knowledge, networks ties, personality traits with an essence of cognition(Ardichvili et al., 2003). This paper adopts the parameters of entrepreneurial alertness outlined in Ardichvili et al. (2003), along with prior knowledge, networks ties, and personality traits to investigate the attributes of recognising opportunities. The section which follows explores alertness, prior knowledge, networks ties, personality traits and its relation to the theme of opportunity recognition.

4.1.1. ENTREPRENEURIAL ALERTNESS

This paper adopts Kirzner's (1973; 1999; 2009) view of entrepreneurial alertness, which is defined as the ability to notice, without effort, opportunities that are generally overlooked by the majority

(Kirzner, 1979: 48). Kirzner also defines alertness as "a motivated propensity of man to formulate an image of the future" (Kirzner 1985: 56). In addition, Korsgaard *et al.* (2016) develops this definition further by noting time and uncertainty as other factors of alertness(Korsgaard et al., 2016). Although Kirzner's definition of alertness is based on the foundations of entrepreneurial behaviour, the majority of this research is connected to cognitive schema in psychology. This approach provides this paper with the tools needed to recognise methods or processes adopted by different port authorities which reach different strategies even though they share many of the same characteristics and parameters. Bostaph (2013), in comparing Kirzner's theory of entrepreneurial action with Schumpeter's theory of creative destruction, came to view Kirzner as "contributing to a driving force to the market", and contributed more to entrepreneurial behaviour and research than Schumpeter's theory did. Since then, (See Table 5 and Appendix 1) there has been continuous flow of research on alertness (Ardichvili et al., 2003; Chavoushi et al., 2020; Gaglio & Katz, 2001; García-Cabrera & García-Soto, 2009; Lanivich et al., 2022; Shane & Venkataraman, 2001; Tang et al., 2021). Most of the entrepreneurial alertness research is rooted in cognitive schema and psychological attributes and social interactions (Ardichvili et al., 2003; Gaglio & Katz, 2001). It states the alertness towards information about the current market as well as consciousness of new market for future new business ideas (Ardichvili et al., 2003; Valliere, 2013). This paper studies the entrepreneurial action described by Kirzner via the specific lens of 'opportunity recognition', using an input-process-output framework to further investigate the antecedents of alertness which recognise opportunity for future strategy decision making.

From the strategy decision marking perspective, three level of alertness can be introduce, namely scanning for information, realising associations between different topics, and understanding capabilities for carrying forward judgment and evolution (Tang et al., 2012). In contrast, both Kirzner (1973) and Baron (2007) belief that entrepreneurs do not actively search for information. In contrast, some of the more recent research shows that alertness is a continuous process and involves searching for information that gives insights into new opportunities (Obschonka et al., 2017; Tang et al., 2021). Tang et al. (2012) also introduced a 13-item scale that Extends the concept of alertness. These scales have been used by scholars to further investigate other elements connected to opportunity recognition in addition to alertness (Chan et al., 2015; Obschonka et al., 2017; Tang et al., 2021; Uy et al., 2015). Along similar lines, this paper also studies other characteristics in addition to alertness that recognise opportunity.

Authors	Key variables Entrepreneurial Alertness
Gaglio and Katz (2001)	Entrepreneurial alertness Alert individuals vs Non-alert individuals
Ardichvili et al 2003	Alertness Personality traits Social networks Prior knowledge
Miao and Liu (2010)	Individual psychological factors (new imitator) Entrepreneurial alertness Prior knowledge
García-Cabrera and García-Soto (2009)	Cognitive capabilities Personality traits Previous experience

Webb et al. (2011)	Alertness, motivation Leads individuals to a knowledge search Makes connections
Tang et al 2012	Individual awareness of changes Scanning Searching

Table 5: Sample of the key antecedents of alertness

4.1.2. PRIOR KNOWLEDGE

Prior knowledge contributes valuable information in terms of the recognition of opportunity. It is defined and measured by the whole knowledge base of an individual at a specific time (Arentz et al., 2012) and has a continuous growth capability. Prior knowledge makes it possible for an individual or for management to collate information which already exists with information that they need (Shane, 2000). Prior knowledge is an acquired capability based on previous work experience, education, hobbies and leaning skills (Venkataraman, 1997). Prior knowledge makes it possible to distinguish individuals who have insights in the market compared to those who do not. This helps in recognising the value of input from different individuals, and making it easier to distinguish ideas that are implementable in real life contexts.

Kontinen and Ojala (2011) presents a translation of prior knowledge in their different categories, namely industry knowledge, internalisation knowledge, and market specific knowledge(Kontinen & Ojala, 2011b, 2011a). Industry-specific knowledge is related to more operational, innovation-related topics such as the latest technology and digital platforms that can improve businesses and make them more competitive in the market (Park, 2005). Previous experience in dealing with business network ties can provide information and insights into new customer's demands or new market segments (Ucbasaran et al., 2007; Westhead et al., 2001). Westhead and Wright (2001) states that companies which have individuals with industry-specific knowledge tend to approach business from outside their comfort zone. In contrast, the lack of such knowledge can make it harder for companies that aspire to become more internationalised, i.e. they lack understanding about the way the industry works or the stakeholders interact (Cohen & Levinthal, 1990). Market-specific knowledge concentrates more on markets that focus on people, culture, climate, business patterns and beliefs (Dögl et al., 2012). Hills et al. (1999) presents special interest knowledge as a category as well. Special interest is defined as specific knowledge about an important client or sensitive information about business development (Shane, 2000). It can be concluded that prior knowledge can provide companies with the necessary tools to compete in innovative business. For this study, along with alertness, prior knowledge is considered to be able to identify antecedents.

4.1.3. NETWORK TIES

The intention of network ties, both internal and external, is to provide individuals with the opportunity to build relationships and interact in a business environment (García-Cabrera & García-Soto, 2009). Business environments consist of business-level relationships which link management with management (Lenney & Easton, 2009) These relationship links also influence communications which can contribute to new business ideas (García-Cabrera & García-Soto, 2009). Business ties consist of customers, association representatives, lobbyists, management, and legal advisors(Axelsson & Easton, 2016). There are also network ties which are informal (Kontinen & Ojala (2011), which are social (Johanson & Vahlne, 2003), and ties which are more formal (Barney, Clark & Alvarez, 2003). It can be concluded that network ties contribute to the knowledge base and insights of an individual (Granovetter, 1973). In addition, network relationships allow the possibility of receiving scare resources from the network that can assist in recognising new opportunities (Hsueh et al., 2010). Furthermore, there are some well-developed conceptual models which study network ties from an embeddedness perspective (Gnyawali & Madhavan, 2001).

4.1.4. PERSONALITY

Personality is an attribute studied from the stream of psychology, and is similar to alertness (Ardichvili et al., 2003). Personality includes attributes like efficacy, attitude towards risk averse, independent thinking, consciousness of surrounding, and attitude towards control and creativity (Ardichvili et al., 2003; Baron, 2007; Kedmenec et al., 2014). Personality consists of efficacy (Tominc & Rebernik, 2007) risk taking mentality (Baron, 2007; Foo, 2011), setting higher goals (Kickul et al., 2009; Kickul & Gundry, 2002; Kickul & Lyons, 2020; Wood & Pearson, 2009) and seeing the bigger picture rather than the possibility of failure (Baron, 2006; Foo, 2011). From the perspective of risk taking, individuals who demonstrate self-correction while mediating risk tend to recognise opportunity more quickly in a complex network. On the other hand, the attributes of intelligence, creativity and thinking outside the box has been deemed imperative for recognising innovative opportunities (Ardichvili et al., 2003; Baron, 2007; Ramos-Rodríguez et al., 2010). Similarly, imagination and open mindedness to learning also qualify as entrepreneurial attributes (Shane, 2000; Shane et al., 1995; Shane & Venkataraman, 1996) It is difficult to measure the impact of personality on opportunity recognition; however, the contribution of individual personality can be realised in a management setting. Since management teams are a group of individuals, it is imperative to take the personality attribute into consideration when investigating opportunity recognition.

A reasonable conclusion to draw is that these factors influence the core process within the port authorities' strategy process in seeking value sought. Archichvili et al. (2003) argue that firms can achieve value sought and develop value-creating ability. This paper adopts a similar understanding, arguing that the existence of entrepreneurial opportunity eventually contributes to coopetition ports' value sought ability through entrepreneurial alertness. Therefore, as stated previously in this paper, port coopetition business strategies should not be considered by themselves, but along with the port actors within a port jurisdiction, and with the port associations who affect the implementation of a valuable opportunity.

5.RESEARCH QUESTION

Much research has emphasised the point that port authorities have the ability to create strategies that go beyond their traditional landlord function in order to develop entrepreneurial behaviour towards their business (e.g. Verhoeven, 2010; Van der Lugt et al., 2013; Hollen et al., 2013). In this research, to identify the existence of entrepreneurial behaviours, the extent to which entrepreneurship exists in coopetition port authorities is explored. One mechanism for doing this is to connect the literature of port authorities' strategies, which is rich in the managerial practice of creating innovativeness, with the opportunity literature, which emerged out of the entrepreneurship literature. This can be studied through the context of coopetition authorities' strategies, which takes into consideration different factors while developing strategies for the existence of entrepreneurship alertness within their managerial role and activities. As seen above in the literature of port authorities' strategies, if not stated clearly, it can be surmised that most the strategies undertaken have the essence of entrepreneurial alertness within them. It seems that entrepreneurial alertness can also be signified by the ability to adopt new roles and to successfully change per market circumstances (Notteboom & Winkelmans, 2001) and the ability to be proactive in creating strategic value by showing the ability to improve the international competitiveness of firms in the port-industrial complex (Hollen et al., 2014).

This section presents the findings of the case study research conducted in the interview phase of this paper's research. As explained in the methodology section, the exploratory nature of these case studies helped to create a more profound understanding of the theme of opportunity recognition within coopetition port authorities, given the scarcity of relevant empirical work. The input of the exploratory case study research in addressing the central research question of how coopetition ports recognise opportunities to creates 'business like strategies' was particularly useful. To do this, the following were investigated: "How do the coopetition ports recognise opportunities to creates 'business like-strategies'?" To answers this question, the following questions were investigated:

4. What are the 'antecedents' which were the catalyst of the mergers that correlate with entrepreneurial alertness?
5. What are the 'antecedents' in opportunity recognition that drive coopetition ports to ultimately create value?
6. What are the 'antecedents' coopetition ports need in order to avoid value void outcome or creating new opportunities?

This case study investigated opportunity recognition in coopetition ports through a process of analysing the strategies implemented within these ports. Using the lens of opportunity recognition theories, this paper studies the prerequisites needed for alertness that recognises opportunities for C-level management. The concept of coopetition was introduced as a combination of competition and cooperation, to provide services to evolving shipping line strategies (D.-W. Song, 2010). Coopetition port authorities are defined as service-oriented ports that have two or more collaborations with previously isolated ports, where the aim is to achieve competitiveness and use their geographical advantage optimally. This development in governance also enables management to be more entrepreneurial and autonomous, should it wish. This paper believes that entrepreneurial alertness and autonomous nature give coopetition ports an advantage over landlord port authorities as they are more alert towards opportunities. One might hypothesise that to recognise opportunity, a prospective entrepreneur should not only be preceded by a state of heightened alertness to information, they must also display the novel behaviour of entrepreneurial zealousness towards that opportunity.

Section (7) provides the methodology used in this paper, which outlines the case study methodology, with case selections in addition to the data collection and data analysis procedures. Section (6) provides the conceptual model, which is built on the theory of opportunity recognition. This conceptual framework will be used to identify the critical factors and antecedents of the three research questions. Section (7.3.2 and 7.3.8) examines the data collected to identify the critical factors required for recognising opportunity, the antecedents of creating value sought, and the antecedents that should be included in order to avoid value void.

6. PORT AUTHORITIES' STRATEGIES THROUGH AN ENTREPRENEURIAL OPPORTUNITY RECOGNITION FRAMEWORK

6.1 INTRODUCTION OF THE CONCEPTUAL MODEL

The conceptual model introduced in this paper evolves out of opportunity theory, drawing on Schumpeter (1934) and Kirzner (1973) as foundations. Initially, opportunity might be understood as a need, or precisely defined as a market need or as an underdeveloped resource or capability. The opportunity context of this paper is the complexity of the port authorities' strategies in relation to 'accessibility infrastructure'. The strategies of these ports are, in most cases, dispersed across the geographical region due to their own specific spatial, socio-economic, and regulatory characteristics. This being said, port strategies have evolved through 'outside the box' thinking so as to seize opportunity or, as in the case of this paper, to recognise opportunity even though it is pushing the boundaries of both 'accessibility infrastructure' and its regulatory role. The present conceptual framework highlights the unique strategy transition of landlord ports in becoming more service oriented. The conceptual framework is designed based on the existing literature of port governance, port strategies and opportunity approach.

6.2. CONCEPTUAL MODEL OF ENTREPRENEURIAL OPPORTUNITY IDENTIFICATION FOR PORT AUTHORITIES.

The conceptual model presented is based on an input-process-output model. The input consists of port authorities' strategies and represents innovativeness through resources, proactiveness through organisation and risk uncertainty through the environment sector, all of which influence the processes and outcome.

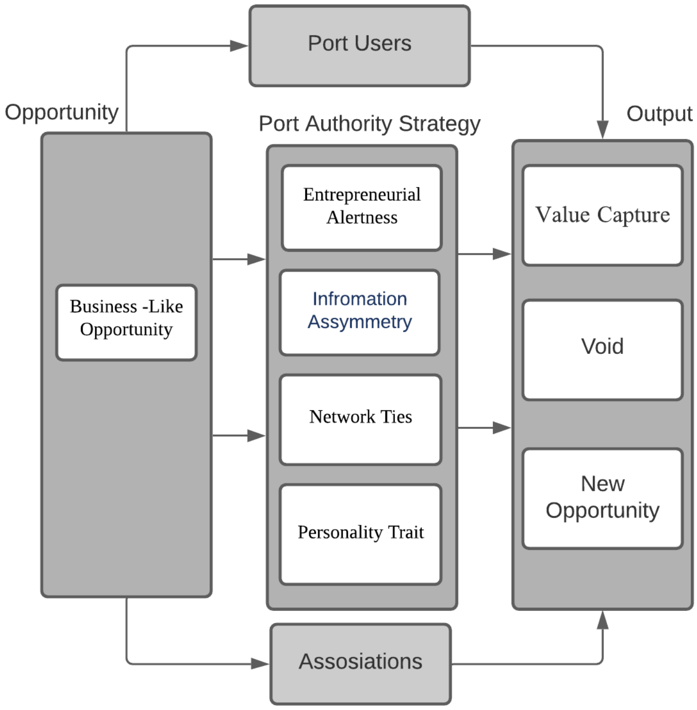


Figure 5:Conceptual Framework

6.1.1. INPUT

The input step highlights opportunities under consideration by the port authorities which have the potential to be developed into strategies. The input stage is defined as "the stage where port authorities are presented with the awareness of a realized opportunity, discovered opportunity, or opportunity created through certain circumstances." The input stage traces how this awareness of potential opportunity converts into an actual opportunity with a specific outcome. Important considerations regarding opportunities include:

- When an opportunity is initially 'realised', this is frequently done by an external port user who put forward their ideas or strategies for development but without directly including the port authority (although it indirectly increases the market potential for the port authority). These ideas may resonate, for example by creating new employment opportunities, or they might conflict with PA strategies, for example by building a superstructure-dedicated business within the internal land of the port which hinders residential views but creates more jobs in the community;
- When the discovery of an opportunity occurs, it might be due to an unknown factor or new ideas from the managerial level;
- If the opportunity is constructed or created, the port authority is intentionally constructing a strategy where the internal port actor should also be included. This created opportunity will evolve predominantly as a result of the port actor's resources being added to the PA's jurisdiction. Most of the time these resources arise out of customer need and market feedback.

6.1.2. PORT AUTHORITY STRATEGIES

The unit of analysis for input within this paper is the 'strategies' of cooperative port authorities. This paper believes that cooperative ports have more capacity to create out-of-the-box 'service-oriented strategies' for their accessibility infrastructure. The criteria for selecting strategies for the EOI process is as follows:

- PAs have a strong influence in developing these strategies;
- PAs are the primary developer of the strategies while others are influencers;
- PAs do not need to be in primary role in the implementation and execution of the strategy; however, it is imperative that both port users and their representatives should contribute to the strategy.

This is a crucial point for clarifying the three criteria considered by this paper, so that the EOI model embodies the essence of applicability, repeatability and generalisability. The study believes that the framework should be applicable to any type of port authority typology so long as the intention is to answer what entrepreneurial antecedents have influence, what are the preferred outcomes and, based on this, what does it need to do to comply with the boundaries noted above.

6.1.3. BUSINESS-LIKE OPPORTUNITY

The first column input represents the port authority's 'business-like' strategies for attracting business and different market parties to rent land or attach more vessels to the port, thereby generating more cargo operations. In this column, we analyse those strategies that take the port beyond the traditional role of a landlord port, where they adopt business-like strategies. The selected strategies are mentioned in detail in the 'case selection' section.

6.1.4. PORT ACTORS

Some of the firm actors that ports have to consider in the context of port actors are terminal operators, customs agencies, inspection, road and rail operators, yard administrators, the operators in charge of loading and unloading goods, and the management of the inland terminals and of the depot. When port actors are also considered to be port users, other groups must also be considered, including the local community, local and regional economies and authorities, port employees (including trades unions), related interest groups, the national economy and central government, and local and regional businesses. Port authorities are aware of this, and proactively attempt to implement networking activities at different levels. With regard to transportation, the opinion of terminal operators will be influential in terms of lobbying and diverting cargo to other ports; hence, it is essential to consider terminals as stakeholders, and as a secondary influence in opportunity identification. For instance, the importance of stakeholder influence on terminals can be studied with specific regard to the association of specific ports, infrastructure pricing and to reduce congestion (P. W. D. Langen, 2006).

6.1.5. ASSOCIATIONS

Local community groups are short-term stakeholders who should be considered at the initial stage of the EOI process. In this case, most opportunity may be gained when the PA holds discussions with the community and an agreement is reached. These discussions may frequently be complicated and require detailed negotiation, especially in places where they have considerable influence, such as in port expansion and infrastructure investment (De Langen, 2006). However, when an agreement is reached that suits both parties, environmental groups will have a long-term stakeholder role in the development of an EOI process, which if taken into consideration by a PA can be a mechanism for creating sought value, and may demonstrate entrepreneurial alertness at the material level. In such cases, the local community will often have more simplified demands, for example in terms of jobs and traffic congestion.

Local and regional government should be considered when regional development is one of the issues. Most of the opportunity identification can be identified through the contribution. In line with the contribution of ports to the regional economy, opportunity identification is blurred with inflexible bureaucracy most of the time, which may hinder creation or entrepreneurial alertness, where the system has to be followed. In recent times the ESPO recognised the need for autonomy where port regulation is concerned; this change can be seen as playing a significant role in the EOI process. These three structures play an important role in how much leeway a PA has in strategy development, and in how much governance influences the PAs in hindering entrepreneurial alertness. As such, a conclusion can be drawn that there is an opportunity void where competitors developed strategies which realise the value sought, hence creating an opportunity void.

6.1.6. STRATEGY PROCESS CONTRIBUTION

The second column highlights the role and involvement of the port actors, i.e. the users, service providers and associations, in the process of port authorities' recognising strategies. The second column examines the strategies through the 'processes dimension', in which the opportunity is processed using three stages. The first stage is the recognition of the opportunity, which is influenced by entrepreneurial alertness. The second stage focuses specifically on implementation where the port user involvement is studied. The third stage is execution, which is the stage of the process where the conflicts or problems of port users and government are most likely to emerge.

6.1.6. OUTPUT

This paper focus more on value sought as it is the most economically efficient outcome for the ports authorities' strategies. In addition, this outcome can influence more PAs to be more entrepreneurial whilst also identifying opportunities to develop their strategies. 'Value sought' is adopted from Ardichvili et al. (2003), wherein value sought is delineated as "market needs or as the perspective of prospective customers, which can be achieved by creating a combination of resources so as to realise superior value."

'Value void' and 'new opportunities identified' are two extreme outcomes for customers, which can come into being depending on the implementation and execution of strategies. As stated before, value void may occur when PAs delay the development of their strategies because of conflicts with stakeholders or conflicts between the PAs' inputs. Hence, it is necessary to show the importance of implementing and executing strategies, that the implementation process of the EOI begins when PAs implement their ideas in the process, and that execution indicates the end of the process for developing strategies. Similarly, the 'opportunity identified for customers' is where customers realise their opportunity as the output of innovative port strategies. However, since the PAs' strategies are the unit of analysis in this paper, we can only expect to know from the perspective of the PAs themselves if this is an opportunity identified for customers which would not be biased.

6.1.7. OUTCOME CONTRIBUTION

In the outcome, strategy results are realised through the entrepreneurial opportunity identification model. This paper presents three different kinds of outcomes which are created, namely value sought, value void and new opportunity value. If value sought is created, the port authority customer can identify their own opportunity identification in the future. The other potential outcome is opportunity void, where the opportunity identification was either dissolved by other competitors or was invalid for the market. Where the outcome of new opportunity is created, there is the possibility of opportunity reconfiguration wherein the opportunity can be reconfigured and be implemented and executed again.

7. METHODOLOGY

7.1 INTRODUCTION

This paper uses the case study methodology presented in Yin, (2003) and Miles and Huberman (1994) in order to investigate the antecedents and critical factors that help cooperative ports recognise opportunity. Several reasons are presented for using this in an empirical setting(Miles & Huberman, 1994; Yin, 2003).

- Firstly, Stake (1995: xi) defined a case study as being "the study of the particularity and complexity of a single case, coming to understand its activity within important circumstances.(Stake, 1995)" This research methodology enables the examination of the antecedents present in cooperative ports which can recognise opportunity. This method makes it possible for us to research "how" (Marschan-Piekkari & Welch, 2004). Following Yin's (2009: 18) view that "how and why questions are more explanatory and likely to lead to usage of case studies", our research question follows the exploratory study in answering 'how' questions when the topic of opportunity recognition in cooperative ports is still yet to be explored.
- Secondly, longitudinal data can be explored in case study methodology. This is favourable for this study as data are collected using an abductive research process, visiting, and revisiting cases over the period to examine their outcomes. This is crucial for this research because the strategy outcome develops over time, and it takes several years to understand whether the recognised opportunity did indeed create value for the port authority.
- Thirdly, with respect of analysing the case of the port authority strategy and opportunity recognition theory, most of the research has used case study methodologies to guide their research (Ardichvili et al., 2003; Dooms, Lugt, et al., 2013; Horst & Langen, 2008; Kontinen & Ojala, 2011a; L. V. der Lugt et al., 2015). This has provided may insights into the research carried out using this particular methodology. In so doing, this research uses Yi's definition as a jumping off point: "A case study is an empirical enquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between the phenomenon and context are not clearly

evident; and in which multiple sources of evidence are used" (2009: 23). This paper accepts the definition of port authorities that they are embedded in a dynamic and complex network where port users and port service providers perform different functions that need to be illustrated in specific detail, as outlined in Brooks and Cullinane (2006a). This supports the conceptual model of opportunity recognition and raises the question as to how far it influences the antecedents of opportunity recognition.

7.2. SELECTION OF UNIT OF ANALYSIS

This question is answered by selecting cases that reflect the phenomenon of entrepreneurial strategy. Cases were selected using the criteria outlined by Miles and Huberman (1994). These criteria are as follows: (1) the prospect of implementing the conceptual framework. In this case, the opportunity recognition framework model consists of three dimensions, with the input consisting of port authority strategies – innovativeness through resources, proactiveness through organisation, uncertainty through the environment sector, all of which influence the processes and outcome; (2) the existence of the phenomenon in the case; (3) the prospect of researching analytical generalisation; (4) the prospect reliability in justification of the real-life phenomenon; (5) the flexibility of undertaking research with confidential information.

To comply with the above criteria of case selection (criteria 1-4), it was vital to select port authorities, port users and service providers which represented different organisational structures and sizes, which were involved in different associations, which did not contain the same board directors, and which had different levels of technological innovation. It was also essential to select authorities which had a 'coopetition' structure, i.e. the authority to govern two or more ports in different geographical locations or countries, and whose ownership structure was that of a public limited liability company. Adopting these different characteristics made it possible to analyse various functions of the port authorities and to triangulate and conduct analytical generalisation. In addition, to comply with criterion 4 the prospect reliability in justification of the real-life phenomenon), and to follow the proposed positivist case study research paradigm, the selected cases provided the access to follow throughout the long-term process. The following three coopetition ports were selected as the focus for discussion about strategy and the opportunity recognition process.

- ***THE PORT OF HAMINAKOTKA***

The Port of Haminakotka is a Finnish seaport situated between the European Union and Russia, providing connection by water and road to central Asia and China. It represents the coopetition of the ports of Hamina and Kotka. Haminakotka port provides services including containers, liquids, ro-ro, cargo, gas, and dry bulk. It has a 3.5 km long quay with 12m draught, and approximately 3,000 ships call annually.

- ***THE PORT OF KVARKEN***

The Port of Kvarken is a Swedish and Finnish seaport situated near the Baltic region. It represents a coopetition between the Port of Vaasa and the Port of Umėa. It provides services to cargo, ro-ro, bulk and ferry operations. The quay has a 7.5m draught and is 2.5 km long.

- ***THE PORT OF ADP***

The Associated Danish Ports is a Danish port operation covering the Port of Frederica, Middelfart and Nyborg. The ADP handles biofuels, recycling products, containers, project cargo and cruise ships. There are 1,447 ship calls annually. The draught is 11m and the quay length is 365m.

As regards port authorities, medium-sized ports in Denmark, Sweden and Finland were selected for interview. They had similar organisational structures and port functions but different competitive foci. In total, three ports were selected for analytical generalisation; As regards port service providers, the Danish, Swedish and Finnish Port Associations were selected. As regards port users, Danish regulators, and representatives of port users such as trade and employer organisations were selected, so that a general view concerning confidential information from port users could be captured.

7.3. PROCESS OF DATA COLLECTION AND ANLAYSIS

7.3.1. INTRODUCTION

Following (Thomas, 2011), the analysis of the selected port actors provides a rich illustration of the interdependencies and analytical insight into the contribution of C-level management in terms of recognising and implementing entrepreneurial strategies. It should be noted that there is always the possibility that the data emerging from the selected port authorities would be insufficient in terms of providing valid arguments to the research. However, the positivist research paradigm and using the stated case study criteria suggests that the selected case studies ought to follow a literal replicated logic (where cases present similar outcomes) or a theoretical replication logic (where cases present different outcomes) (Rowley, 2002; Yin, 2003). This should also help in accomplishing theoretical saturation in our enquiry (Eisenhardt, 1989)Secondly, the aim is to pursue "generalisation at the theoretical propositional level and not to population or universe" (Yin 2009: 21).

7.3.2. DATA COLLECTION

The data collection process between February and December 2017 was iterative. It involved conducting interviews, studying documents and undertaking observation, suggesting the pursuit of triangulation (Yin 2009; Thomas 2011). The interviews conducted with C-level management (CEOs, CFOs, CCOs etc.) were the main source of information; document analysis and observation were used to support this, and to add more information to interviews about the specific port functions where digital resources were exchanged by different port actors. This was a way of confirming that the information collected through interviews does have an actual source present in their physical business. The full list of data sources and interviews conducted in the study is listed in the table (6) below.

Table 6:List of Data Sources and Interviews

PORT ACTOR	INTERVIEW WITH THE COMPANY	INTERVIEW WITH ACTORS INDICATED AS IMPORTANT
Port Authority	Port of Haminakotka	Chief Executive Officer
		Chief Commercial Officer
		Chief Financial Officer
	Port of Aalborg	Chief Executive Officer
	Port of ADP	Chief Commercial Officer
		Chief Financial Officer
		Chief Executive Officer
	Port of Køge	Chief Commercial Officer
	Port of North	Chief Financial Officer
Public	Danish Port Association	Director
	Finnish Port Association	Chief Executive Officer
	Danish Freight Forwarding Association	Head of Politics
	Danish Shipbrokers Association	Chairmen
		Chief Executive Officer
Private	Swedish Port Association	Chief Executive Officer

7.3.4. INTERVIEW METHOD

The interview method was planned in such a way as to gather as much as rich qualitative information as possible from experts. This approach was based on the explorative nature of this study, as well as the possibility of conducting the study longitudinally. There were instances where 7ome interviews provided more insights about the port network and their relationship with each other. 15 interviews were conducted in total, with each being around approximately three hours long. Most of these interviews took place onsite with the interviewee, with three being conducted online via Skype[4]. Babbie's (2012) snowball sampling was adopted in order to answer the question of "whom" to interview next. This was achieved by asking the interviewee to either (1) suggest the next potential colleague who has expert knowledge on our phenomenon of interest (in the case of port authorities), or (2) to suggest companies with whom they have key relationships with (in the case of port service providers or users).

[4] Skype is a voice or video call service.

7.3.5. DATA TRIANGULATION

To accomplish data triangulation in our data collection and to obtain a more comprehensive insight, for each type of port actor more than one interview was conducted. With regard to port authority strategies, the goal was to investigate the antecedents that recognised port authority opportunities. For this reason, C-level management were interviewed so that a comprehensive perspective on the port functions of berth requests, crane bookings, waste pickup, renting enquiries, water and electricity, and invoice tracking in their organisation could be attained. With regard to the port authorities – the Port of Haminakotka, the Port of Kvarken and the Associated Danish Ports – it was possible to interview all C-level management and mid-level employees in the companies' networks. For triangulation, in-depth interviews were carried out with the director /CEO of the Danish Port Association, the Danish Shipbrokers Association, the Danish Port Companies Association and the Danish Freight Association.

7.3.6. QUESTIONNARIES

The questions in the interviews were informed by a theoretical analysis of the port authority strategy literature and opportunity recognition theory. Particular focus was given to the context of collaborative digitalisation strategies and work in progress ideas. During the interviews, it was assumed that conversations about strategy would organically move towards the topic of entrepreneurial strategy and digitalisation. In some cases, good examples of the challenges faced by the cooperative port authority with regards to digital information sharing projects were also given. The questions about strategy were purposefully abstruse so that the interviewee did not focus only on a positive narrative, but rather described their learning in terms of both strategic success and failure, as well as the preparations which they undertake as they search for opportunities, especially on digitalisation topics. Interviewees were open to sharing generic knowledge about their strategies for competitive advantage which they considered to be important, such as in February 2017 when the CEO of the Port of Haminakotka captured new business with a customer from Kazakhstan.

7.3.7. CODING METHOD

The data were analysed using reduction, display and verification processes (Miles & Huberman, 1994). First the transcripts were prepared for coding using the template presented in Kings' (2012) template analysis. The codes were created based on the opportunity identification literature, as noted in the literature review section. Interview transcripts, field notes, observations and documentation were analysed. The coding process was undertaken using NVivo (Figure 6). Our pathway to analysis was guided by the steps presented in Kings (2012), and consists of reading and reflecting on the transcript, coding and reflecting on the data, and then refining it.

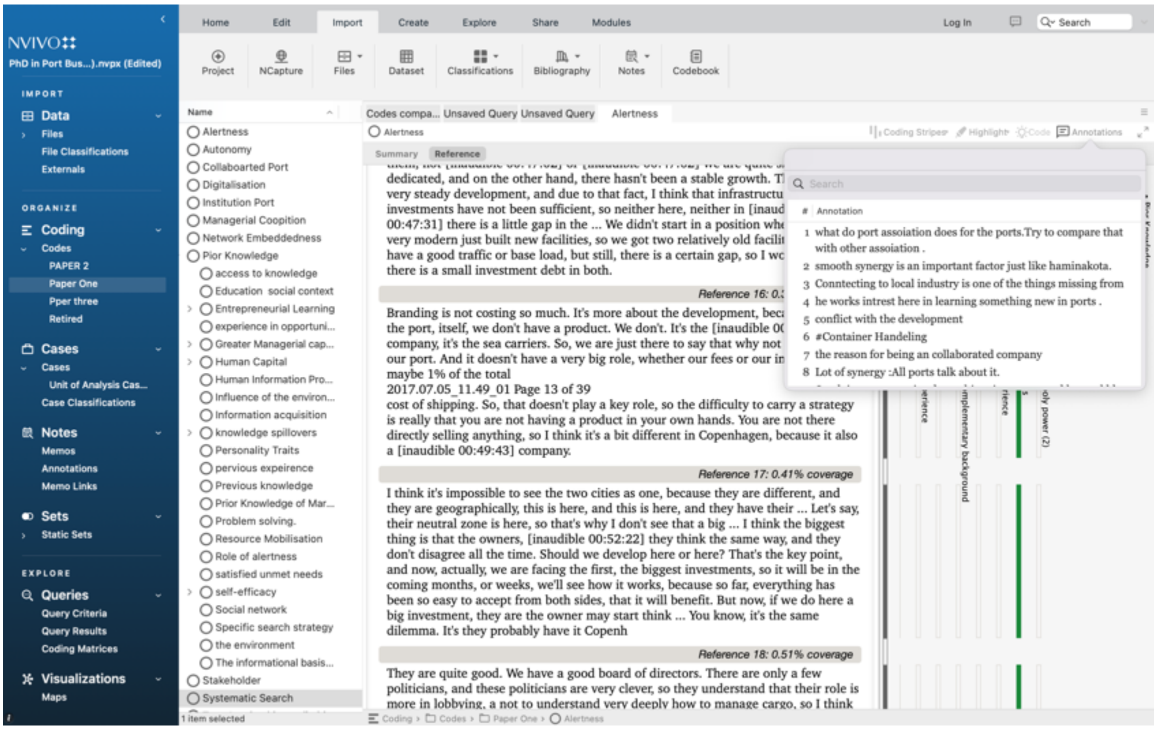


Figure 6: Snapshot of Nvivo and Coding Process

7.3.8. PROCESS OF CODE SELCTION

Table 7 provides a small example of the codes used for analysing the interviews and investigating the core antecedents that recognise opportunity (See Apendix:1 and Appendix 2[5]). The coding was divided into two coding cycles: (1) NVivo coding was done to highlight the keywords used by the interviewees as they answered specific questions about digitalisation; (2) elaborative coding was used to code based on previous studies conducted on opportunity recognition theory and port strategy. In addition, this coding made it possible for this study to corroborate the opportunity research with the port authority research. Following this, (3) value coding was used to highlight the antecedents connected to entrepreneurial alertness, autonomy and creditability. Interpersonal trust is an important keyword for entrepreneurial strategies to achieve value sought, especially if the value which the port is trying to create is essential for the port authority's survival. As such, value coding is used to acknowledge interpersonal trust interaction between different port actors. The second cycle of coding was done using (4) theoretical coding, which further examined the antecedents of alertness and yielded the three antecedents required to create value sought, one of which was entrepreneurial zealousness. Value coding, using NVivo and elaborative coding, contributes to the next steps of reflection and refinement to answer our research question.

This section has explained the data analysis method and the procedures for capturing and summarising what the data show. In table 7 we explain the key code which were chosen from the literature to code the data, focusing particularly on the use of elaborative and theoretical coding. In this analysis, the port authority strategy and opportunity recognition literature used codes that were

[5] Appendix 1 and Appendix 2 are added in the Endnote.

initially used to highlight the antecedents of alertness, autonomy, prior knowledge, and personality traits (e.g., Shane & Venkataraman, 2000; Gaglio & Katz, 2001; Ardichvili et al., 2003; Fischer, 2011; Tang et al., 2012; Sharma, 2018; Chavoushi et al., 2021; Lanivich et al., 2022). The variables taken from Ardichvili et al. (2003) were used for elaborative coding. NVivo was used to highlight the essence of the interviewee and their definition for explaining the concept of entrepreneurship.

Table 7: Sample of the List of Codes used for Coding.

CODE LEVEL	CODE	DESCRIPTION	CODING TYPE	CYCLE
Main Variable	**Prior Knowledge**	Shane and Venkataraman (2000: 222) – the individual discovers opportunities due to having acquired prior knowledge	NVivo Elaborative Coding Theoretical coding	First Second Third
Antecedent	Access to knowledge	'Access to knowledge' selected as a code was suggested by the CCO of ADP ports. He defined it as the possibility of gaining customer knowledge when they have questions	NVivo Value coding	First
Antecedent	Entrepreneurial Learning	Selected from the interview with the CEO of Haminakotka	NVivo	First
Antecedent	Customer problem	The problem was clearly defined by the customer as 'this is a problem', 'this is the issue' etc.	Value coding Theoretical coding	First Second
Antecedent	Lack of Knowledge and Skills	Individuals miss discoveries due to a lack of knowledge (Kourilsky & Esfandiari, 1997; Kourilsky & Walstad, 1998)	Elaborative Coding Value coding	First Second
Antecedent	Ways to serve the market	Selected from the interview with the CCO of ADP port	Elaborative Coding NVivo	First Second
Main Code	**Value sought**	Presence of antecedent and positive outcome from a new opportunity	Value coding Theoretical coding	First Second
Antecedent	Overarching	When the port authority behaves in the context of a coopetition port	Elaborative Coding	First
Main code	**Value Void**	Absence of antecedent	Value coding Theoretical coding	First Second
Antecedent	Complex scenarios	When two opportunities are interconnected	Elaborative Coding Theoretical coding	First Second

Antecedent	Divergent thinking skills	The port authority is not acting as a landlord port but is entrepreneurial	Elaborative Coding	Second

Following this, value coding was used to illustrate the important strategies which highlight the entrepreneurial essence of innovation and proactiveness, and which were different from landlord port strategies. Each strategy was coded under the antecedents (e.g. alertness, interpersonal trust, or autonomy) and was also given the code of either value sought or value void. Following this, elaborative coding was used to shape each antecedent into a sub node, e.g. entrepreneurial zealousness had the attributes of openness to experience, which was explained using keywords such as 'curious', 'imagine' and 'mindset'. This provides insights into what each expert executive thought about strategies or opportunities. The second cycle coded operationalising alertness antecedents into a more entrepreneurial antecedent of zealousness which is suitable for port authorities that are government organisations and are only allowed to play the role of an initiator. The theoretical coding highlighted the positive impact of entrepreneurial zealousness on value sought, with a negative impact when excluded from strategies that were entrepreneurial in nature. This is further reflected in our contribution and conclusion section.

7.4. CASE DESCRIPTION

The underlying principle for deciding on case studies for companies has been to select "information rich cases", namely cooperative port authorities which are worthy of in-depth investigation (Patton, 1990: 181). As explained in the conceptual framework section (6.2), the selection of cases has been based on three criteria.

- Firstly, the selected port authorities have exhibited a coopetition typology with some degree of business-like strategies which can be characterised as 'entrepreneurial cooperative' port authorities. The Port of Haminakotka has achieved significant results through this strategy, attracting new business as a cooperative port authority. Similarly, Kvarken has been constantly transforming itself and refining its strategy to add new dimensions to their limited infrastructure. ADP can be characterised by its strategy whereby it has initiated new ways to do business which push the boundaries of landlord port businesses and the perception of its customers.
- Secondly, the selected coopetition port authorities cover a wide spectrum of strategies that were transformed into projects, a wide spectrum of value creation activities, and a wide spectrum of countries of origin. Indeed, the three port authorities operate in distinctive environments (e.g. biomass, forestry) that shadow the landlord port typology (See Figure 8). Moreover, they are involved in many different areas of value creating activities (e.g. customer services, new business revenues, new digital products, and marketing and sales), are cooperative ports in Nordic countries (Denmark, Sweden and Finland), and are of different sizes (ranging from 50 to 1,000 employees).
- Thirdly, the selected coopetition port authority business strategies were realised as an

opportunity before the merging of the of the ports, and are still in existence after the merging of the ports. The strategies selected in the Port of Haminakotka were an opportunity recognised by the C-level management as a business idea which had potential. The merging of the ports made it possible for them to develop them into strategies to either attract new business (e.g. Case #1) or to maintain current business (e.g. Case #2). We selected the digitalisation project in the Port of ADP because it existed as an idea before the merging of the three ports. In the Port of Kvarken, we could recognise only one strategy that existed before the merger that was high on the priority list of the port. Realising the situation, we selected another opportunity that was high on the list for all three ports (Case #3).

- Fourthly, the selected coopetition ports have been identified within the cultural and political areas of the Nordic countries (Denmark, Finland, and Sweden) for proximity and compatibility reasons. In addition, this paper also includes port associations and port customers for triangulation and hopes that this analysis of the relationships between different actors will provide a wider spectrum of 'antecedents' in the cooperative ports business.

Table 8: Case Description

The Investigated cooperative port authority					
Unit of Analysis	YEAR	Business-like opportunity	Size	Country of Origin	Reform
Haminakotka	2015	Case #0: Port coopetition: Reconfiguration of the organization	Medium	Finland	2012
	2005-2018	Case #1 - Concentrate on Russia: geographical location, accessibility to final customer, knowledge of the customers' customer; and visibility of customer.			
	2009-ongoing	Case#2 - Focus on Kazakhstan: to "replace" old customer with new business opportunity.			
	2014-ongoing	Case#3 - Digitalisation project to transition all port companies in Finland			
Kvarken	2015	Case #0 Port coopetition: Reconfiguration of the organisation	small	Sweden	2015
	2015	Case #3 - Digitalisation Project to participate in a single window development and port community system.			

	2014-2022	Case #4 - Ferry Terminal for Ferry traffic.			
ADP	2015	Case #0 Port coopetition: Reconfiguration of the organisation	medium	danmark	2016
	2014 - 2022	Case #3 - Digitalisation Strategy to build a database that gives insights into customers and potential business opportunities			

7. HOW DO THE INVESTIGATED PORT AUTHORITIES DEFINE ENTREPRENEURSHIP?

The current research examines a theme of entrepreneurship which places a greater emphasis on trade in the port authority literature. Most of this literature belongs to the port authorities' strategy stream in which the notion of entrepreneurship is discussed as a factor for the strategy to be implemented beyond the scope of the port authorities. Entrepreneurial notions are manifested in coopetition port authorities that have moved beyond the scope of the landlord port model. Using the explanation from (L. V. der Lugt et al., 2015), "entrepreneurial undertaking" is defined through discussion on one or more strategies that move "beyond the scope of landlord port authority's role" to reflect their identity as coopetition ports. Taking this as a starting point for entrepreneurs, this paper focuses on the strategy of coopetition port authorities, which will lead to the presentation of ideas about how the management of port authorities can explain entrepreneurship.

Table 9: How does Port Authority define Entrepreneurship?

What is Entrepreneurship (Alertness or Zealousness)?		
Port Authority	Term used with strategy	Manifestation of strategy
Haminakotka	Innovation Prosperity "For us it is to always to get customer. The customer is of course at the end who is paying everything, and this is the most important thing, but there are also other things affecting the entrepreneurship strategy is continuous improvement."	▪ Investment in flexible infrastructure; ▪ Improvement in digital innovation company.

ADP	Market Learning "The main difference is that we have moved from being a port authority or an infrastructure handling company to be a logistical partner. Our vision is taking more part of the value chain of the transport, so the logistical value chain."	▪ Improvement of internal business processes and work practices in sales; ▪ Process innovation of creating new customers.
Kvarken	Learning orientation "That's a difficult combination. I think it works, but in the beginning, it has been quite a lot of work to make people understand that this is not the same company anymore. We are in a process of change and in a process of careful change and we need to learn quickly how to achieve it. "	▪ Innovative organisational restructuring; ▪ Innovative use of infrastructure between cruise and ferries.

As is evident from previous research, the definition of entrepreneurship (Table 9: How does Port Authority define Entrepreneurship?) tends to revolve around strategy goals of different port typologies which are mainly related to coopetition port, or else a business-focused view that provides a good understanding about a particular component of the port authority business. This coopetition ownership has provided the port with more infrastructure accessibility, meaning that there is a greater opportunity for discovery. This paper argues that this recognition of opportunities will help extend the boundaries of the landlord port rather than the limited exploration possibilities that are possible based on the two extreme port typologies, i.e. landlord port or private port.

8.CASE ANALYSIS: OPTIMISING LAND USE OR DIGITALISING

This case study investigated opportunity recognition in coopetition ports by studying the strategy implemented in their port. Using the lens of opportunity recognition theories, this paper studies the prerequisites needed for 'alertness', recognising the available opportunities for C-level management. The concept of coopetition, a portmanteau of 'competition' and 'co-operation', was introduced as a concept to reflect evolving shipping line strategies (Song, 2010). Coopetition port authorities are defined as service-oriented ports that have collaborated more than twice with previously isolated ports for the purposes of achieving competitiveness and the optimal utilisation of their geographical advantage. This development in governance also enables management to be more entrepreneurial and autonomous. This paper believes that their entrepreneurial alertness and autonomous nature gives cooperative ports an advantage over landlord port authorities in being more alert towards opportunities. One might hypothesise that in order to recognise opportunity, a prospective entrepreneur should not only be preceded by a state of heightened alertness to information, but must also include novel behaviours such as entrepreneurial zealousness towards that opportunity.

8.1. CRITICAL FACTORS: BUILDING A PORT COOPETITION

This section (8.1.) focuses on the critical factors of building a coopetition port (Table 9: How does Port Authority define Entrepreneurship? and Figure 7: Critical Factors). As explained in section (7), the Port of Haminakotka and the Port of ADP engage in coopetition port strategies, while the Port Kvarken is more risk averse. These port authorities are actively involved in entrepreneurial alertness, which they see as integral part of their business performance. For example, by reconfiguring three cities under one organisation, Haminakotka has become the most important port in Finland. Specifically, through reconfiguring its organisation, the port avoided double investment since previously they had two different container terminals in Hamina and Mussalo which handled container traffic. This is now concentrated solely in Mussalo. This concentrated performance means that other terminals can focus on different forms of traffic to increase certain types of business, meaning that they are alert to opportunities to create different types of specialist traffic in each of their eight harbours.

Over the last three years, ADP invested in a larger sales and marketing department in order to secure more business opportunities as a 'value chain' rather than just an 'infrastructure' port. For the first time they invested in market research in order to gather customer satisfaction reports, which could be used to concentrate on specific business. Kvarken has invested heavily in reconfiguring their organisation between two different countries, namely Sweden and Finland, so as to capture the cargo and ferry traffic and decrease competition between these two terminals in close proximity. This said, alertness seems to be a key word in all the three port authorities under analysis. An 'alertness towards reconfiguration strategy' took place in all three ports when they realised that the organisational structure needed to be reconfigured in order to capture opportunity. To achieve this, they first updated their vision to capture the opportunity by concentrating investment and decreasing competition through 'synergy of strategy', an approach which avoided double investment between two different ports or terminals. Secondly, in order to reconfigure the organisation, they changed their organisation mindset towards new market learnings with new management.

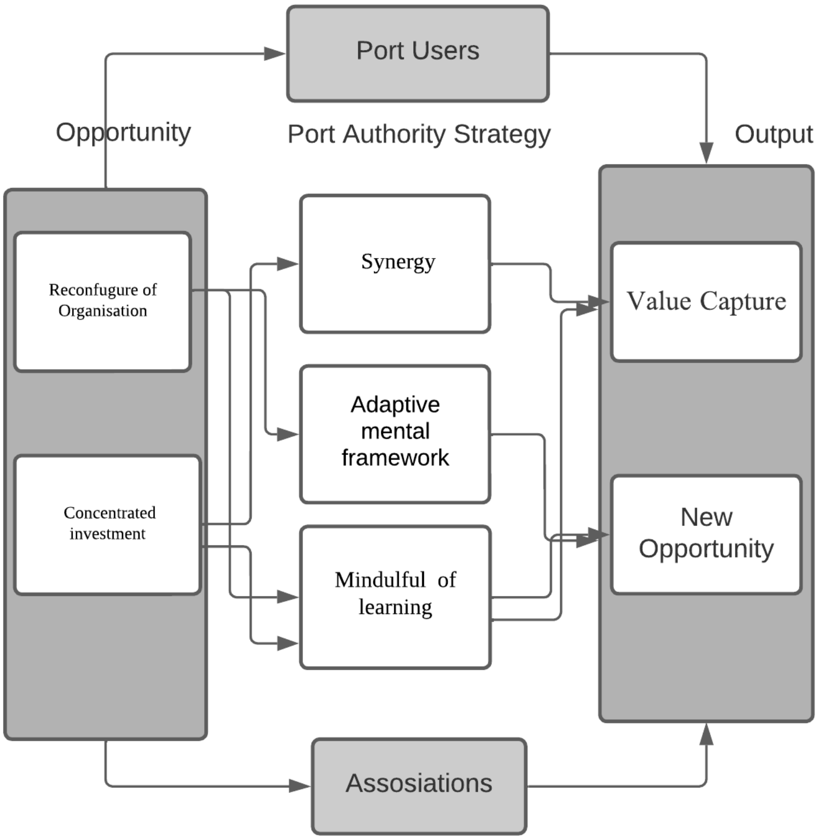


Figure 7: Critical Factors

8.1.1 SYNERGY

Entrepreneurial alertness is a source of profit or potential profit that can be derived from strategy. Entrepreneurial alertness can be recognised in coopetition port authorities when they diverge from their traditional business as a 'port authority' or 'infrastructure provider' to become a business-like company where their focus is on emerging trends, and they can identify new market parties and coordinate with customers to attract more business to the port's boundaries. 'Synergy' was a critical factor reflected in each interviewed port, although only two ports recognised and captured it in their strategy. When referring to their strategy to change into a cooperative port, the CCO of ADP stated that:

> "The main difference is that we have moved from being a port authority or an infrastructure handling company to be a logistical partner. Our vision is taking more part of the value chain of the transport, so the logistical value chain."
>
> *CCO of ADP*

Similarly, the CEO of the Port of Haminakotka showed the principle of alertness. Through their own coopetition strategy to find synergy, the CEO argued that:

> "The main strategy is to find synergies with collaborating ports that have a same profile to avoid double investment. This is the most important thing right now to avoid double investment. We are doing a lot of things for environment to improve the condition of the ports. Haminakotka port aims to be the leader, who sets examples for other ports in Finland to follow."
>
> *CEO of the Port of Haminakotka*

Similarly, information was gathered from an interview with the CCO of Kvarken Port, who was most experienced in value chain port and collaboration. The vision was stated as follows:

> "The collaboration between Finland and Sweden was created to try and capture the opportunity of the one million passengers a year using the ferry business. When this dropped to 40,000 a year, the two cities of Umeå and Vaasa decided to try and understands these changes, and the Nordic logistics corridor project was developed. The aim was to bring the traffic of one million people through the Bothnia corridor to Sweden."
>
> *CCO of the Port of Kvarken*

In contrast to the CCO, the CEO and CFO of the Port of Kvarken had different ideas about coopetition strategy. They argued that the essence of alertness is part of the management, although there was a lack of synergy between the three C-level management individuals with respect to synergy. The term, as used by the CEO, reflected the vison of the CCO to show that there was a need to change physically as well as functionally in order to capture synergy in strategy:

> "There were two separate companies, and it was more to get the roles clear, so that we are not competing with the same traffic. That's what they were doing in the history, and then, it was also, as a cost-wise, to get the synergies out. There were two companies, two administrations, two managements. So we made the decision that it's only one management sitting in Umeå, and we strip out all unnecessarities from the other location."
>
> *CCO of the Port of Kvarken*

Even though the CFO of Kvarken was part of the reconfiguration of the port, it seems that the vision as regarded 'synergy' was different as he could only talk about the Port of Umeå. This was particularly the case when the CFO was asked explain Case #6, the railway connectivity opportunity, where Umeå was mentioned:

> "I think it's, if I start with Umeå, because I know that better than Vaasa, it's quite good. I think we have a lot of investments in railroads here in Umeå so it's very good for the customers that can come with a train and go with a boat, or come with some lorries and out to the trains, you have every possibility. And then you have the ferry that goes to Vaasa so I think it's quite good. But in Vaasa, maybe there's a little bit more work to be done. The

railroad is not so developed so I think they can do more there. And we, I suppose can do more there."

CFO of the Port of Kvarken

This was recognised and repeated by the CEO of Kvarken, identifying the need for synergy of strategy and synergy of vision.

"The mistakes were done with Euro Ports. For example, the branding was something that in Euro Ports, I think that it was started a bit late, but here, it was already prepared a little bit, and I took it as a very serious matter, so that you have to do the branding well, so it's not acceptable to use a Swedish company name, Umeå port, but they still do, which is horrible for me, because you always have to say, 'Hey, stop it.' You can only say, that's the official name. There is no other name."

The need to realise entrepreneurial alertness, strategic synergy, awareness of business opportunity, and mindfulness of change needs to be manifested in all C-level management. With regards to the reconfiguration of the organisational strategy, it was created with the alertness of decreasing double investment, concentrating investment, and managing competition. Although this was initiated in three ports, it was concluded by Haminakotka and ADP. They demonstrated strategic synergy and mindset harmonisation as well as market learning of new business opportunities. Moreover, synergy is needed to capture the organisation's reconfiguration value. In this paper 'value is captured' when all the added value offered by the port authority is optimally utilised. This relates, in particular, to newly acquired and merged infrastructure.

8.1.2. ADAPTIVE MENTAL FRAMEWORK

An adaptive mental framework or schema is present in an individual who thinks 'outside the box', and are more entrepreneurially alert to competition and its challenges (Gaglio & Katz, 2001). In the case of the Port of Haminakotka (Case #0), to fully realise the opportunity to merge three ports together was considered a long-term undertaking. To implement a successful merging of the three ports under a port authority, a committee was organised, consisting of individuals with particular expertise. Three individuals on this committee had an open mentality, and stated in their interview that 'change' was needed in order to capture the opportunity offered in different geographical locations.

"Yeah, I think the process leading to the abolishing of the laws and the requirement to corporatize took its time, I mean took a few years. So, they had time to get used to the ... They knew what was coming up and had the mentality to change, and I mean behind both of them are competition issues. If they adapt the understanding that they are better grouped up with someone else, than alone. Haminakotka they're very close to one another, so there was actually ... Well probably you know all of that, that there was a sort of over-capacity, because the two local authorities were competing with one another. This was the way of getting rid of the unhealthy competition between the local authorities."

Deputy Director of Finnish Port Association.

Similarly, the port association deputy directors also stated that 'change mentality' or 'change mindset' was one of the key factors that contributed to successfully complete the merger. Moreover, the deputy director herself demonstrated 'awareness' to the task they were undertaking, and the advantages which would be accrued once it was achieved. Along the same lines, the managing director of Kvarken was open to adapting to these new ways of working with the swedes, and was aware of their own capability as a company. This said, there was also awareness about their geographical limitations.

> "It was quite easy, because Finns are quite reasonable, so they understand that there is no need for two in a small company."
>
> *CEO of Kvarken*

In addition, similar attributes of alertness were shown by the CFO of Haminakotka and the CCO of ADP ports where they were 'recognising the potential' of the merger by providing a set of strategy examples (e.g., Cases #2 #3 #4) which, due to their alertness, could capture endogenous knowledge and translate it into value.

> "First thing which comes into my mind is that our service scope is wider than in any other port in the Baltics. I don't know any other port which has so wide range of different type of services. That's valuable for us. That's, I believe, the biggest advantage of why we merged."
>
> *CFO of Hanimakota*

> "Yeah. The main difference is that we have moved from being a port authority or an infrastructure handling company to be a logistical partner. Our vision is to take more part of the value chain of the transport, so the logistical value chain."
>
> *CCO of ADP*

Moreover, the CCO of ADP stated that it was time for the port authority to evolve from just being a landlord or infrastructure ports to being part of a value chain as a logistical partner. This attitude of self-efficacy was reflected in the marketing strategy of their merger, the conversation they started internally to change their mindset and the investigation they stated internally to map their IT infrastructure to prepare projects on the optimisation of manual systems. This all reflects the fact that the Port of ADP has a high alertness to opportunity.

> "So, we broaden up the business and open up for opportunities to do business in a different way than we did before, and it has to be a balance between the private operator and us as a public owned company"

CCO of ADP

In the context of merging the ports, important factors include self-efficacy, change of mindset, change of mentality and recognising the potential needs to be embedded in management alertness and vision. With regards to the pre-attributes of the management before the implementation of the reconfiguration of the organisational strategy, it is suggested that a merging of the ports would have been impossible if the management were not ready to change and move into the unknown. This consciousness to alertness is needed for both the Port of Haminakotka and the Port of ADP, to successfully recognise opportunity for their coopetition strategy.

8.1.3. MINDFULNESS OF LEARNING

The term 'mindfulness of learning' mainly talks about the ability to recognise deviations and then integrate them into a pattern of meaningful outcomes (Gaglio & Katz, 2001; Gordon & Schaller, 2014). This pattern of processing information has a direct connection to discovery and innovation (Gordon & Schaller, 2014). In respect to the Port of Haminakotka, the C-level management were mindful of the changes they needed to make when approaching a new customer.

> "Trust is that if some company promise that if you do this and this, we will use your port and they fill their promises later. They pay what we have negotiated and agreed with each other. The most important thing is that if we construct or build something, that means money for us so we have agreement that they use those things so that we can get our money back….unfortunately it can be also so that we can even have some kind of agreement and we do something and later the client says that, 'Sorry, we have now another ideas and let's throw sometimes later that what we do.' There is as well ... I think the Russians are even better than middle Europeans companies."
>
> *CCO of Port of Haminakotka*

In both case #1 and case #2, the attribute of 'self-correction' was demonstrated when approaching clients in Russia and Kazakhstan. To capture new opportunities in Russia, the CCO was aware of the cultural aspect that needed to be taken into consideration, and to adapt to the new business setting of that country. This experience afforded the CCO the opportunity to be mindful about difference, and to learn the attribute of 'self-correction' while deliberatively searching for opportunities. 'Self-correction' is defined as an attribute of mindfulness, which is used when faced with changes, risks or emotions. This attribute played a key role in the relationship building with this new client in Kazakhstan.

> "It's the same because you know one of the things, we are developing right now is a business with Kazakhstan and it's kind of different you know, how we interact with them and so on compared to Russia."

CCO of Port of Haminakotka

The CEOs of Kvarken and ADP displayed mindfulness when discussing the impact that the merger would have internally on their organisations and employees. It was likely that some employees would leave, that some employees' job descriptions would change, and that some employees would be worried. They were both aware that they needed to simultaneously learn about the new organisation whilst communicating internally to employees about the reconfiguration.

> "In a personal level, of course, it's difficult to accept, and it was also, like in this exercise, in Kvarken ports, we were aware that there were also some cultural issues, because Umea is a Swedish speaking city in Finland, but Vassa is not. So, there was some cultural collapse, which is also here. I come from Finland, people are here, Swedish, and vice versa. People coming from Sweden to Finland, it's not difficult, but there's always some small differences. What is important for me is that we learn from each other and be aware of each other culture difference."
>
> *CEO of Kvarken*

Furthermore, it is important to state that opportunity can only be recognised if the coopetition port is mindful of the shortcomings both internally and externally. They are mindful that certain things have to change for them to recognise the opportunity. For instance, the CEO of ADP expressed mindfulness regarding the strengths and weaknesses which needed to be understood to turn the opportunity into strategy. The ADP ports was aware that there was certain judiciary restriction that would hinder their pace of recognising new opportunities.

> "So, what we are, or should I say I am trying to do now is that we are trying to develop our company by learning about what has to be done, but at the same time we are trying to make friends on the political agenda in Copenhagen because its new to other just like it new to us. So we try to change the law, so we have what we call a level playing field between the cities in Denmark. And that's not what it is today. So in that sense ADP is a bit weak. But the other hand is that it's very clever seeing by the owner that they actually take this step now."
>
> *CEO of ADP*

To capture more value in the current business and to create new business ideas, coopetition ports show mindfulness towards learning at times when management is being encouraged to be more profit focused. The notion of following 'self-correction' through mindfulness (Kelly & Dorian, 2017) prepares coopetition ports to slowly transition to new forms of recognising opportunity.

In summary of these critical factors, this paper argues that port authorities need the antecedents of synergy, an adaptive mental framework ('change mentality' or 'change mindset') and mindfulness of learning ('self-correction') to create a new strategy in a coopetition port. The cases cited highlight that these attributes existed long before the ports reconfigured themselves from landlord ports to coopetition ports. These attributes can provide future landlord ports which aspire to be coopetition ports with insights as to what management experts need at the forefront into to make this a reality.

8.2. ANTECEDENTS FOR OPPORTUNITY RECOGNITION OF PORT COOPETITION MANAGEMENT.

This section (8.2.) examines the antecedents of opportunity recognition of Port coopetition (Figure 8).

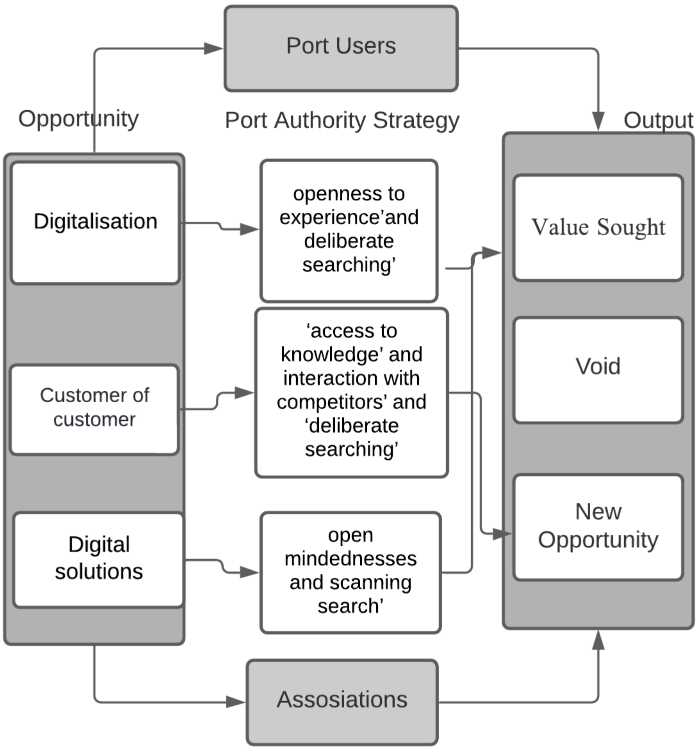


Figure 8:Antecedents for Opportunity Recognition

8.2.1. ENTREPRENEURIAL ZEALOUSNESS

In contrast to alertness, the antecedent of entrepreneurial zealousness requires both autonomy and interpersonal trust characteristics to achieve value sought in creating strategies. Zealousness was the main antecedent which emerged from each successful strategy. This consisted of an 'openness to experience' attitude in recognising opportunity, even with the disadvantage of having limited knowledge and limited authority. In particular, entrepreneurial zealousness was the key antecedent for the CEO of Haminakotka Port when investigating the topic of digitalisation, who noted that they were open to change and indeed had already included digitalisation as a part of their strategy. However, the CEO had 'awareness' early on that the port could not be number one in digitalisation because of their size in comparison to the giant companies investing in the field. Nonetheless, the CEO decided to try and apply the concept of digitalisation by being a part of it, and focusing on value sought rather than competition. When asked about digitalisation in the interview, the CEO responded as follows:

> "We are also trying to take pleasure in the ports. For digitalisation as a whole, we can't of course be the number one because there are bigger and more specialised companies, but we try to apply the best methods as soon as they are there for our meetings here."
>
> *CEO, Haminakotka Port, 2017*

When asked about ambitions for digitalisation, the Haminakotka CEO stated that they valued automatization. This was a different approach to the one taken by the Port of Kvarken, where the CEO recognised the potential of digitalisation but did not show any 'openness to experience'. They understood two theories of digitalisation: when customers take the initiative to start a project for themselves, and when they do not. Due to the small size of their port, they decided to value void the opportunity. We argue that the digitalisation of business processes can create 'value sought' to smaller ports, in particular by adding value to their customers (port service providers).

> "We have a lot of paper documents that needed to be that. But it's a little bit of a problem because of the structure of this port, we have an agency that's quite small and they work only with papers. So, they are only a couple people there, so I understand them, it's not easy. And then we have the stewarding company, which is owned by the SAA Logistics, it's very big. So, we have different types of partners and people that work here, so it's not so easy to just say that 'Now we are going to digitalize everything, and you have to do it."
>
> *CFO of Kvarken Port, 2017*

In addition to 'openness to experience', there was also interest in 'deliberate searching' within the boundaries of the port authority. Coopetition port authorities are constrained to their boundaries as defined by ownership structure, port laws and regulations. However, most of these regulations define the operation and administrative part of the port authority and do not guide port authorities in their quest for survival. For instance, the CEO of ADP stated that they depended on one customer (agent) to bring business into the port. The result of this, however, is that the dependability and survival of the port authority depends on the agents who might not take the port authorities dependability into consideration for their strategy. This provided an opportunity for ports to be more proactive in undertaking 'deliberate searching' for their opportunity. Through
deliberate searching', ADP wanted to gain more insights about the market from the digital platform and wanted to find customers that would mutually benefit form selecting ADP Port for their business. Doing this would attract more business not only for ADP Port, but also for their agents.

> "As a port, back in the old days, you would normally say you create value by having a super optimised infrastructure that runs on the time, that's it, okay. That's also a need. But what I think for the future is more or less that we have to optimise the logistic, that must be our purpose for our customer. What are we? We are, yes we are a port, and the infrastructure has to be 100% okay, but to create value for you as a customer that wants to live here there has to be more than that. And that has to be digitization, information sharing, information. It could also be, perhaps in the future, some kind of … form … not a workshop but a way of

getting together and helping the customers coming out to the next customer. It could be trans-shipment projects where we need to find customers for them out in Scandinavia, for example. It's a way of motivating and bringing value to existing customers."

CEO, ADP Port, 2017

The antecedent of entrepreneurial zealousness can be achieved in cooperation ports by implementing 'openness to experience' and 'deliberate searching' into their processes of recognising opportunities that create value sought. However, we argue that both 'openness to experience' and 'deliberate search' cannot be isolated as they must be considered as part of the strategy, along with autonomy and trust.

8.2.2. AUTONOMY

Autonomy and entrepreneurial zealousness are antecedents that work optimally together to create value sought. Cooperation ports are bound by their port law and their ownership i.e. public limited liability ports. Autonomy can be defined as 'autonomy to make strategies' and 'autonomy to make strategies without a conversation with a lobbyist'. Both were discovered in the analysis of autonomy. As noted by the Port of Kvarken, the executive board does not decide the strategy autonomously, but has to inform lobbyists. This is evidenced below:

"The board of directors is the one that decides the strategy – how it should be. Because if you are a limited company, and you have a board of directors, it's the only way that everybody carries their own role. The MD has a role to report to the board of directors, and the board of directors has a role to report to the politicians".

CFO, Kvarken Port, 2017

ADP port, however, takes a different view, as a new cooperation port which is experiencing autonomy for the first time. In this case, the autonomy lacks resources from customers and customer agreements to be more proactive in attracting business to the port. ADP port is a public limited liability port, meaning that it has autonomy to create value sought strategies beyond what a landlord port can do, should there not be any customers ready under the recognised opportunity. This emphasises the argument that autonomy alone cannot recognise opportunity, but there also has to be 'access to knowledge' and 'interaction with competitors', especially in this case, where their customers are also sometimes their competitors.

"Autonomy is good, but no strategy is stronger than the forces that influence it, and those aspects: the customer, the officer, society as a whole."

CFO, Port of ADP

Previously, Haminakotka port had recognised the opportunity of doing business with Russia. When they were approached by their customers (agents) to work together to capture the market, they were very open to the idea of collaborating with their customers, as shown below:

> “Let’s take Russia, you have people following the situation. We are very close here, to the Russian border.”
>
> *CFO, Haminakotka Port, 2017*

However, the port then forecasted that the current economic situation would affect their car export business with Russia due to falling oil prices, which had reduced the potential in Russia. Previously, they had had autonomy in getting ‘access to knowledge’ from the end customer. Adopting a strategy to replace their customer (agents), an old customer with a new customer, they created value sought by winning a five-year contract with Kazakhstan. Focusing on a new country was not a straightforward opportunity for the port, but the autonomy given by their customers gave them the opportunity to create marketing activities to attract business in Kazakhstan.

> “The autonomy from being a coopetition port gave us the opportunity to analyse what are the options. It’s always needed a lot of marketing and activities, and we realise there are many growth areas in Kazakhstan, and we wanted to be part of it. So, we went there gather information, build relationships and then put our customers in touch with them.”
>
> *CFO, Haminakotka Port, 2017*

The antecedent of autonomy is only applicable when ‘access to knowledge’ is incorporated into autonomy. Autonomy, by itself, cannot provide enough support to zealousness in ‘openness to experience’ and deliberate searching. Access to knowledge, in broad terms, equates to market knowledge, customer knowledge and customer visibility, i.e. the opportunity to communicate with the customer. These are only possible for a public limited liability port when the customer trusts the port authority. The combination of interpersonal trust, autonomy and zealousness can recognise opportunities that create value sought for port authorities.

8.2.3. INTERPERSONAL TRUST

This paper argues that interpersonal trust is one of the antecedents (along with entrepreneurial zealousness and autonomy) that differentiates and separates value sought with value void. As public limited liability ports, port authorities have limited jurisdiction and so depend heavily on other parties, such as agents, to attract business to the port. With respect to digitalisation, Haminakotka port heavily invested in digitally sharing information whilst also being aware that there was a line which they could not cross. This is where ‘scanning search’ for customer problems began. ‘Scanning search’ refers to the process of scanning your customer searches or enquiries so as to gain insights into their needs. This ‘scanning’ highlighted the pressing need for port companies to digitalise the paperwork and go paperless in order to benefit their customers. Their customers, however, lack the expertise and capability to guide themselves through digital transformation. With the aim being the creation of more opportunities to collaborate between customers, the Port of Haminakotka invested in a sister company which, as a neutral IT company, could provide digital solutions to their port customers. This kind of ‘out of the box’ solution could gain customer trust, and this alertness to the digital information sharing opportunity is described below by both the Chief Finance Officer (CFO) as well as the Chief Commercial Officer (CCO) of Haminakotka.

"We don't have such an important role in the port because we are more or less a landlord port, so it is not so important. But our own IT company is doing a little of that kind of thing. All the Finnish ports are clients of our IT company. For example, we don't have forwarding, so we don't do that. That is in the digital sector, that is one of the main matters. We closely cooperation with customers, and when the vessel comes to our port, it is under our control. We give the ETA to the customer, and not to the coast guard but to the Russian border, as to whether everything is okay or not. That is one of our roles, but we are not sharing the message of what kind of cargo there is. That is not our job. It is forwarding, and we don't do it. We don't share what is not ours. We never did."

CFO of Haminakotka Port,2017

"…digitalisation, one of the important parts is trust, because you tend to mostly base something which is electronic and non-touchable with your customers. And then trust depends a lot on saying, 'Hey, I will sign the invoice,' for instance. Or 'I will transfer the invoice from the customer to a bank,' or 'I will take the bill of lading and give it to you, as a proof that your cargo is loaded.' So we don't make big changes but participate. Well, like, for example our operational system is very much involved with the software called Portnet. And it's run by the Finnish Traffic Agency. They are the operator, they are operating the Portnet, but we used the information and we also ... input a lot of information in it."

CCO of Marketing, Haminakotka Port, 2017

Similarly, under the strategy of sharing information digitally, the CFO of ADP compared 'open mindednesses' to trust, stating that digital information sharing exists due to "open mindednesses of the masses, but in some realities, this is not possible due to lack of trust."

"The first thing is when you're sharing information, it's always in some ways it's a mass of trust, or it's a matter of being so convinced that if you don't do it, you will lose in the long term. Meaning if you see in the young people today, right, for them it's 100% normal for them to share information. They don't see it as a weakness, sharing information, like. So, I think if we, it will be a chance mentally, and also compared to your business, how do you make money? But for me it will always be that I need to motivate to get more goods out on the ports. Out on the ships. Because that is money for me, more or less."

CFO of ADP Port, 2017

However, the CEO of ADP created 'value sought' opportunity by connecting their 'openness to experience' with 'trust' by communicating the opportunity with customer and being transparent about future opportunities. This opportunity of working together with their customer to capture value sought should eventually create a similarly trustful environment as exists in Haminakotka port.

> "It's actually today, it's saying to people here in the business ... when I came they said, Nils [the CEO] we cannot go out to the end customer. And I said why not? Because Fredericia Shipping's doing that. And then I said, yeah but that's not enough for me, it's too uncontrolled. So let's go to Fredericia Shipping and tell them about it. And try to explain to them that it will create extra value for them for zero cost. And we did that. And actually, they accepted it, more or less at once, and saying as long as you tell me about it, it's okay for me. So the need of having a trustful relation is very important at moment because we are trying to open up a development."
>
> *CEO, ADP Port, 2017*

Both ADP and Haminakotka ports realised the importance of a digital sharing information strategy. However, Kvarken decided not to invest in this dialogue, and showed no desire towards 'openness to experience', stating that the digitalisation of information already exists as a single window platform for ports, with its only limitation being its Eurocentric focus, and there would be a good opportunity for someone to make it accessible internationally.

> "Actually, it's a sexy term. Everybody wants to use it without understanding it correctly, but in a port perspective, when of course, the fact is that quite much of the information flows are already digitalised. For example, the single window company gets all information … not all, but the majority of the information in a digital format. As such, I think, a port authority, which we are … I think what is needed, which is amazing that nobody has ever developed, but a similar global system, which they do have in flight, in air traffic, that there would be only one platform."
>
> *CFO, Kvarken Port, 2017*

For triangulation purposes, the success or avoidance of these strategies were corroborated with the Finnish Port Association. They stated that with regards to the digital information sharing platform, they are long way from creating a port community system for all ports, and they welcome ports taking the initiative to build a digital information sharing platform for their customers. They understand this is not an easy strategy to implement, and so they endorse the entrepreneurial zealousness of the port authorities.

> "It also ties into the broader digitalisation aspect. We tried for several years, been sort of following the processes and following the initiatives, to start what is called the port community system. Because Port Net is not a port community system, as such. It's a reporting system. Unfortunately, I think that's one important aspect of the Finnish Port market, you could say, in relation to many other countries, our ports are relatively small, on average. So, for instance, for whatever digitalised service systems that you start to consider, you need a certain volume of activities. At our latitudes, it's a bit more difficult to sum up than in central Europe, or even in ... well, Denmark."
>
> *CEO, Finnish Port Association, 2017*

In summary, this paper argues that port authorities require the antecedents of entrepreneurial zealousness (‘openness to experience’ and deliberate searching’), autonomy (‘access to knowledge’ and ‘scanning search’) and interpersonal trust (‘open mindednesses’) to build strategies that create value sought. The example cited of digital information sharing strategy also highlights the absence of antecedents that create value void for port authorities.

8.3. ANTECEDENTS TO AVOID VALUE VOID

This section (8.3) investigated the outcome of value void (Figure 9: Value Void).

8.3.1. ABSENCE OF ENTREPRENEURIAL ZEALOUSNESS AND VALUE VOID

Being conventional ports, none of the port authorities in this research intended to identify their first opportunity. Rather, they happened to receive certain information about an international opportunity and subsequently decided to pursue it. For example, for market-specific reasons, Haminakotka port entered the Russian market only after potential customers started contacting them about roll-on/roll-off cargo, asking them for help with regards to ‘deliberate scan their customers’. This alerted the company in terms of prior knowledge. For industry-specific reasons, Kvarken decided to invest in buildings at their dedicated ferry terminal for their long-term ferry operations. For customer-specific reasons, ADP began building a new customer database. Only the ports of Haminakotka and ADP have invested in business-like strategies which embody entrepreneurial zealousness. In comparison, the strategy of Kvarken port had alertness to opportunity, but the absence of zealousness created an outcome which was more ‘value void’ than ‘value sought’. The avoidance of zealousness can be seen by the absence of ‘openness to experience’ and ‘deliberate searching’ in recognising opportunity. There seems to be a lack of clarity regarding the new freedom that the Port of Kvarken can experience in terms of port coopetition, specifically in experiencing the opportunity to new selections of strategy. As seen in the interview quotation below, no clarity was provided by the coopetition committee that hired the CEO, and no proper orientation was conducted in terms of what the intention was regarding port coopetition.

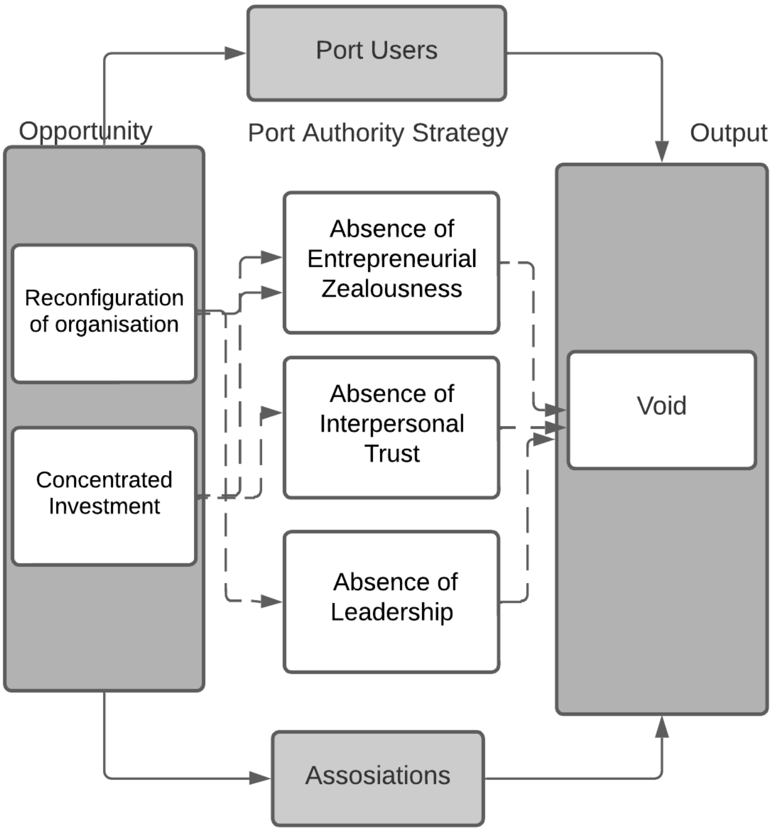


Figure 9: Value Void

"To be honest, when the company was established, we didn't have a clear strategy, so that was mainly a decision to combine two assets as one company, and our task was to create a strategy in the first year, which is what we did."

CEO, Kvarken Port, 2017

As explained by the Port of Haminakotka and the Port of ADP, cooperation ports did not have to exclude themselves from their customers. Even though they were not responsible for finding new customers, they took on leadership roles in their port community and built a strategy to 'scan the market' together for more business opportunities. It seems that both these ports had entrepreneurial proactiveness and a sense of leadership which they could use to start a conversation with their customers and to gain their trust by being transparent about their strategies. In comparison, the port management in Kvarken displayed an absence of 'openness to experience'. This absence of leadership emphases the absence of zealousness in their opportunity recognition, as can be seen in the quotation below:

"No, they don't have no such role. It's railroad operators. Green cargo has been quite active, and there are some, let's say, very promising new operators also, but they are, for example, there is one very interesting topic going on with the traffic that could come from Finland with the ferry, and then, would go by rail to Stockholm, and of course, we are there to plan it, how can it happen. But again, we are not, at the end of the game, we are not the freight forwarding companies. We don't do the moves. We don't move the railways or rail wagons; we only administer this infrastructure."

CEO Of Kvarken port, 2017

8.3.2. ABSENCE OF INTERPERSONAL TRUST

In this section, the paper highlights the absence of antecedents found in the port authority when investigating the antecedents of opportunity recognition. With respect to Kvarken port, value void can be seen in Case #3, concerning digital information sharing strategy. While discovering the antecedents of entrepreneurial zealousness, autonomy and interpersonal trust, we saw an absence of these antecedent in the Port of Kvarken. This was mostly the antecedent of interpersonal trust; entrepreneurial zealousness and autonomy were either missing, or there were only traces. One of the major factors for the Port of Kvarken not being as entrepreneurially zealous was its size. As a small port, it did not hold enough interest amongst port users to be considered as a 'top ten key port' for lobbyists.

"There is of course a sort of a problem. You can't really build proper infrastructure to every port; that is not sensible. So, you have to do some type of choice, what ports should be prioritised? And, that is, sort of key, both a key issue and also sort of impossible issue for us as an organisation to point out, because everyone is member, is a member, it is a very difficult for us to say, "Well, you're a member, but we shouldn't prioritise your port." But the government had pointed out about ten key ports. They are called Central Ports."

CEO of Swedish Port Association, 2017

Communication between the Port of Kvarken and its client were very reactive, and Kvarken's CEO depended predominantly on receiving funding before planning development and finding value. The process of developing strategy was more fund-based than opportunity-based, which created disadvantages for them in terms of exploiting all the autonomy they could receive as a coopetition port. The essence of interpersonal trust is seen in the Port of Kvarken's belief that clients will approach the port with ideas and opportunities. However, this also means that they are still acting as a landlord port, and are not reaping the benefit of the competitive nature of a coopetition port. The Port of Haminakotka, on the other hand, is a very good example of a port which promotes interpersonal trust by proactively connecting their customers to other customers beyond their geographical region. This paper argues that interpersonal trust can be increased with communication, transparency and consistency between the port authority and customers. However, to accomplish interpersonal trust, 'proactiveness' is needed in order to show dependability and creditability, both of which were absent due to port authorities' reactive nature and inability to think outside the box.

> "No, we don't have any big industrial projects in place. That's the problem. Or then, you should just take the big risk, and first develop the structure, and then, just wait and cross your fingers."
>
> *CEO of Kvarken port*

> 'Our old customers that are working in our port, they are very important as well we do together with them. They want to meet our Russian companies. We have to go straight to the Russia clients and get the trustful stakeholders. That is very important.'
>
> *CCO of Port of Haminakotka*

To understand ports like Kvarken and their dependency on funding rather than innovation, we triangulated this with the Finnish Port Association, who have experience with the configuration of coopetition ports, and know other coopetition ports that have been successful. They stated that the reason port authorities were given the opportunity to reconfigure as coopetition ports was to provide them with the opportunity to make decisions quickly, to think outside the box, and to be more proactive. The Port of Kvarken, however, is a merger of a Swedish and a Finnish port, and therefore an assimilation of two cultures, two different type of customers, and two different languages. The effect of this can be seen in the absence of entrepreneurial zealousness due to a lack of interpersonal trust in culturally merging two ports.

> "The major argument being that being a corporatized entity, that would speed up your decision-making process, as compared to being a landlord. Sort of having an open window to the local assembly, and the local politics. That by being a corporatized company all by the local authority you'd have a greater ... You'd be able to prepare for taking decisions when you're dealing with commercially sensitive issues, you'd be better sheltered from others gaining knowledge of your intentions in this way."
>
> *Deputy Director of the Finnish Port Association*

8.3.3. AUTONOMY

Autonomy is another antecedent that was absent in Case #0 and Case #3 at the Port of Kvarken even though the essence of a coopetition port in comparison to a landlord port is its autonomy to make fast decisions and think outside the box, creating incidents which increase interpersonal trust and entrepreneurial zealousness. However, being more funding dependent, the Port of Kvarken was only focused on infrastructure investment, and waited for the rest to come later.

> "… we have the power to plan them, of course, but at the end of the day, it's really a question about financing them, because we don't have money. We're a small company with not so good muscles to take a loan, or so and getting investment is a challenge."

CEO of the Port of Kvarken

This view was contradictory to the views of the CCO as to how the Port of Kvarken should be more autonomous in building customer relations through its marketing strategy. This view, however, was not reflected in the rest of the management team, who focused more on funding rather than starting conversations, searching for opportunities, or scanning searches. This absence created a value void for Kvarken.

> "We can, as support, we can all ... what can we do, we can make contacts and we can try to and start to, you know the shippers and the shipping companies need to talk to each other. We have established a lot by ourselves because we can of course invite the shippers here, shipping companies here, show our infrastructure and tell them about the industry here. And then we can give the contacts to the industry."
>
> "…It's, then again to gather the requests and the feedback and then again taking that off to discussion, this is what are we missing in management board."
>
> *CCO, the Port of Kvarken*

In summary, this paper argues that port authorities where entrepreneurial zealousness, interpersonal trust and autonomy are absent tend not to grow entrepreneurially. This does not mean they do not earn profit, but they are contained to one reactive element rather than proactively focusing on exponential growth based on innovation. The absence of this antecedent creates a value void for port coopetition.

9. DISCUSSION

The initial intention of this paper was to discover the critical antecedents which enabled port authority ports to recognise entrepreneurial opportunity. The paper investigated the port authority strategy of ports which had recently merged into one governance structure in order to capture business which had previously not been possible when they had been a landlord port. To investigate this, the paper selected four different types of business-like opportunities which ended with two different outcomes, namely value sought and value void. As seen in figure (10), to structurally dissect these strategies, this paper implemented an Input-Process-Output framework. This framework was used to examine the transition of opportunity into strategy, and to evaluate whether they were a success or failure. The objective for doing this was to answer the main research question, namely 'How do port authorities of a coopetition port recognise opportunities for their strategies?' Our answer to this question is divided into two sections.

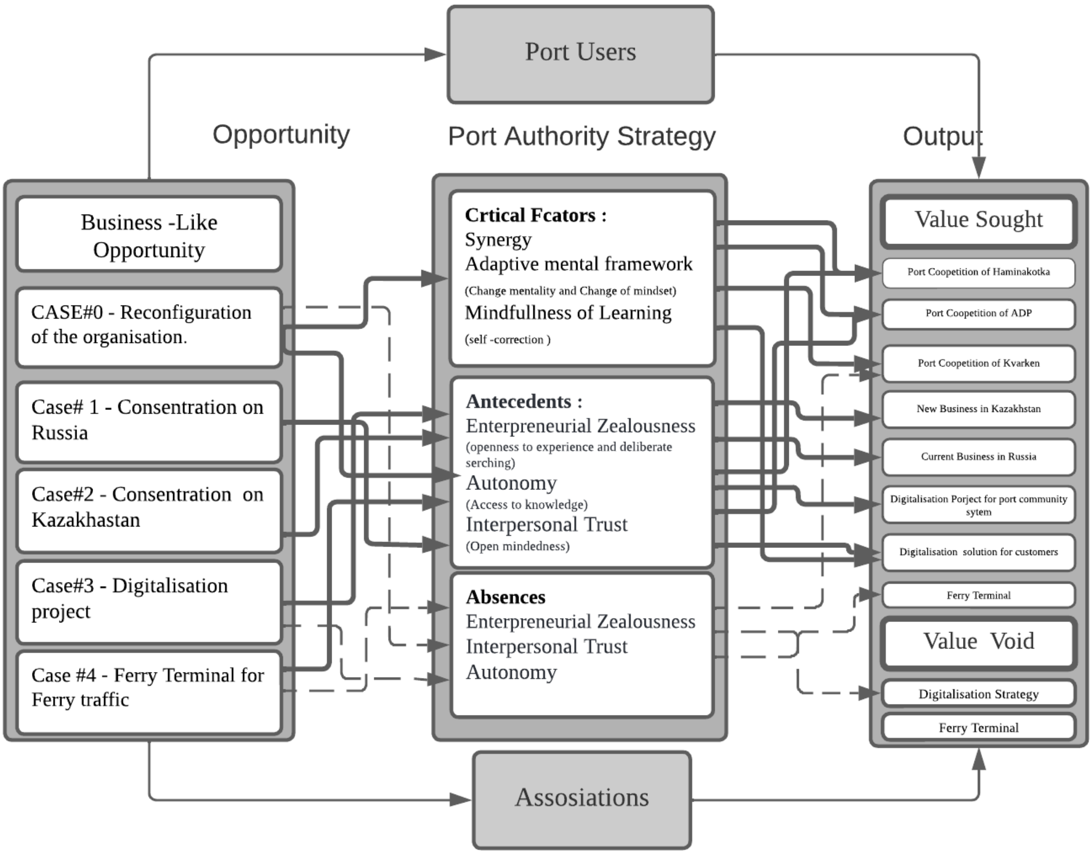


Figure 10: Conclusion of the Opportunity Framework

9.1. CRITICAL FACTORS

The analysis first focuses on the antecedents of entrepreneurial alertness, where it is recognised that the opportunity for port coopetition is a catalyst in their formation. This section concludes that the antecedents propelled the reconfiguration of the organisational strategy into a value capture outcome. Moreover, these antecedents also build a foundation for new opportunities in the future. The antecedents realised were as follows:

- *Synergy*

The antecedent of synergy was realised as one of the critical factors which supported the value capture of port reconfiguration. Only the Port of Haminakotka and the Port of Kvarken contained the principle of this antecedent, specifically in Case #0 of the reconfiguration of the organisation. In comparison, the Port of Kvarken did have the essence of synergy. However, following further investigation the full potential of optimising the freedom of reconfiguration of the organisation was not used in practice. This paper defines synergy as optimising the port strategy by avoiding duplication of strategy for the three different ports, and seeing them collectively as a single entity. Optimising different parts of the merged port can help it reach its full potential. With regards to new opportunities, synergy provides a foundation for future business ideas to grow. These new business opportunities always occur after the completion of the initial value capture in the previous opportunity. As shown in figure (10), the Port of Haminakotka had a new opportunity (Case #3) to start a sister company which could develop digital solutions for its customers.

- *Adaptive mental framework*

The antecedent of adaptive mental framework was recognised strongly by the management of the Port of Haminakotka, which was part of the committee that oversaw the merging of ports in Finland and Denmark (Case #0). They were also part of the reconfiguration of the Port of Kvarken. Adaptive metal framework is an antecedent that can be explained simply as 'thinking outside of the box'. The merging of ports was just an idea, and initially very few people could see the potential it could offer. Later, these few individuals were responsible for convincing the rest of the community about the benefits of port coopetition. The essence of this is recognised in this paper, which notes that an adaptive mental framework in the port authority could be developed through 'potential recognition', a change in mentality and a change of mindset. Awareness was also mentioned as a contributor to the adaptive mental framework. This paper argues that the essence of this antecedent can be achieve mostly through time and communication. In addition, the adaptive mental framework antecedent was also the catalyst for Case #3 (digitalisation projects), which inspired management to investigate the opportunities of embedding digitalisation within their processes.

- *Mindfulness of learning*

The antecedent of mindfulness of learning gave the management insights into the cultural aspect of merging ports, preparing them to be more reflexive in their decisions. The Port of Kvarken, in particular, was a merger between the Swedish port of Umea and the Finnish port of Vassa, and they had completely different organisational cultures. Similarly, the Port of ADP had different business values to their customers. At the same time, the Port of Haminakotka was moving beyond its boundaries to try and capture value through international customers. These opportunities were further developed through the mindfulness of the management. Case #0 established that the value capture of reconfiguration of the organisation was strongly based on customer culture, port authority culture, and employee working culture. The existence of this antecedent created the difference between meeting obstacles or gaining new opportunities after the merging of the port authority. For instance, the Port of Kvarken did not experience the same outcome for Case #3 as the Port of Haminakotka did after the merging of the port authority.

9.2. ANTECEDENTS OF OPPORTUNITY

This analysis takes all the attributes of opportunity recognition which help port coopetition be a catalyst in the formation of future 'value sought' or 'value void'. This section concludes that the antecedents that propelled business opportunities were only an idea before the merger of the port authorities, at which point they became a potential priority. The existence of these antecedents predicted the positive or negative outcome of the opportunity. The antecedents realised were as follows:

Entrepreneurial zealousness
Entrepreneurial zealousness is an antecedent which, together with autonomy and interpersonal trust, can provide opportunity recognition to a port authority. This antecedent played a crucial role in the translation of opportunities into value sought outcomes. Entrepreneurial zealousness helped management select ideas which were not possible to implement as a landlord port. For instance, 'openness to experience' inspired the management of the Port of Haminakotka to further investigate the topic of digitalisation in Case #3. The result was, eventually, value sought in the two projects, i.e. the single window project and the creation of a digital solution (sister company) for the customer. In contrast, there was an absence of 'openness to experience' in the Port of Kvarken. They did not realise the advantages of digitalisation, and were not keen to further investigate the opportunity due to it being not applicable for a small port. Despite this, this paper argues that digitalisation in small-sized ports can create competitiveness and provide the edge against another similar sized ports. We believe this was a value void for the Port of Kvarken.

In addition to openness to experience, it is also important to have the essence of 'deliberate searching' that creates the entrepreneurial zealousness of being proactive in customer search and market search. This antecedent inspires port authorities to connect customers with customers and begin conversations, and to gain full understanding of what customers need. For example, prior to their merger, ADP ports depended on customers to provide insights; after their merger, the port authority could analyse the market to understand the right digitalisation approach. Similarly, the Port of Haminakotka showed entrepreneurial zealousness when they proactively connected to potential clients in Russia and later Kazakhstan, with their current customers bringing more cargo to the port. This entrepreneurial zealousness provided the port authority with two projects in Kazakhstan and Russia (Case #1 and Case #2).

- *Autonomy*

Autonomy is another antecedent that contributes to the recognition of the opportunity process. The antecedent of autonomy is also a synonym for 'freedom of decision making'. The newly merged ports now have the opportunity to be more entrepreneurial in their quest to find new business and grow. One of the factors that supports this is autonomy. Autonomy, in the context of opportunity recognition, allows port authorities to be more proactive in their search for business, connect with customers, and experiment with new ideas. This 'access to knowledge' provides the port authority with autonomy to recognise opportunities. For instance, the Port of Kvarken – just like ADP port – had the possibility of being more proactive in communicating with customers as the link between current agents and future (shippers) customers. Nevertheless, the Port of Kvarken was more focused on funding-based projects such as investing in a ferry terminal project (Case #4), and was reluctant to move outside its comfort zone. This created an absence of autonomy which eventually contributed to value void for the Port of Kvarken. In comparison, the Port of Haminakotka took advantage of its autonomy by connecting to clients in Kazakhstan, which resulted in a project for the port authority.

- *Interpersonal trust*

The antecedent of interpersonal trust is one of the catalysts that helps public limited liability ports reach their full advantage. In the past, port authorities had very limited opportunities to change. Due to their governance structure, they were not allowed to proactively communicate with their customer's customer, instead having to wait for the business to approach them. Public limited liability ports have more freedom to communicate with clients and bring business into the port. This also created more confusion and uncertainties for current customers who have similar roles (e.g. agents and stevedores). In this context, it is essential that interpersonal trust exists between the customer and the port authority, so as to execute opportunities into strategy. With regards to Case #2, the Port of Haminakotka was approached by clients in Kazakhstan to discuss potential business for the port authority. The port authority understood this opportunity, and involved other stakeholders in the ports (e.g. agents) so that there was open dialogue and no confusion. Similarly, for Case #3, all three ports approached the concept of digitalisation but only the Port of Haminakotka and the Port of ADP moved to the next phase of development. Regrettably, the Port of Kvarken chose to focus on its core current business and did not get involved in the digitalisation conversation. In this case, there was an absence of interpersonal trust, entrepreneurial zealousness and autonomy, the combination of which contributed to the outcome of value void.

10. CONCLUSION

Figure 11: Contribution to Opportunity Recognition, explains the contribution of this paper with the refined framework of the opportunity recognition model. The paper studied different business-like opportunities, namely: Case #0 - Port coopetition; Case #1 - Concentrate on Russia customer; and visibility of customer; Case#2 - Focus on Kazakhstan; Case#3 -Digitalisation project; and Case #4 - Ferry Terminal for Ferry traffic. In addition, the paper focused on the antecedents which existed only in the port authority, and studied the interaction and implication of the business-like opportunities for port users and port associations. The outcome is divided into value sought, value captured, value void, and new opportunity. Value is captured when an established opportunity reaches a positive outcome. In addition, if this outcome creates insights which provide a new form of business idea, then the outcome achieved is a new opportunity. Similarly, if a new form of opportunity is pursued by entrepreneurial zealousness, then the outcome achieved is known as value sought. Lastly, value void is the outcome achieved when there is an absence of antecedents. In the section below we discuss the contribution to each variable of opportunity recognition, and further discuss their contribution to each outcome.

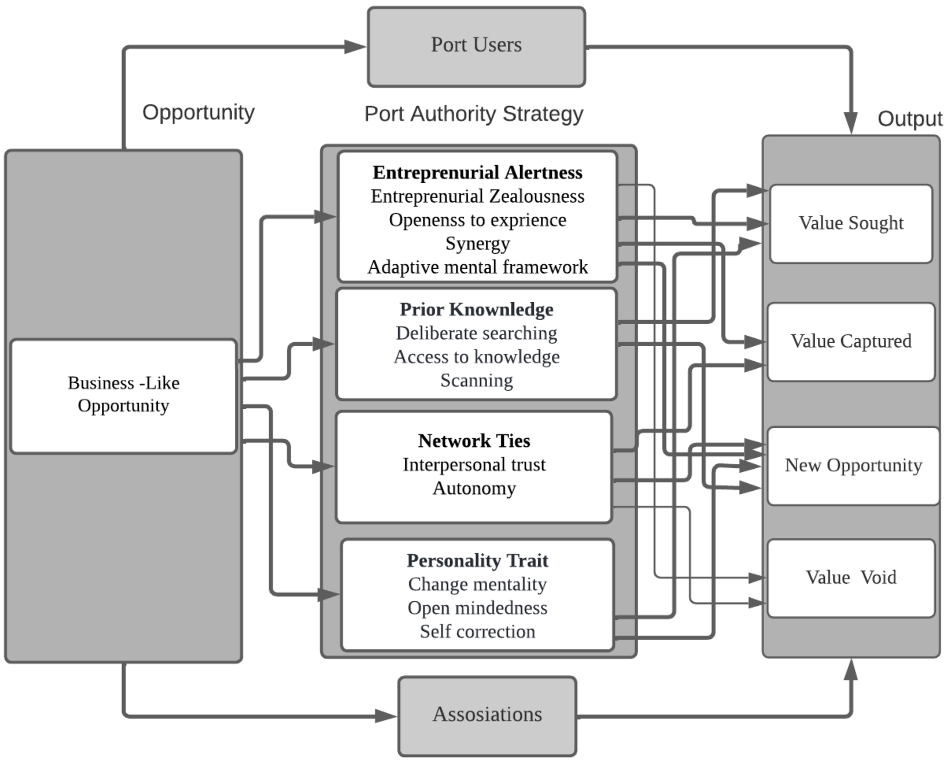


Figure 11:Contribution to Opportunity Recognition

- *Entrepreneurial alertness*

In respect of entrepreneurial alertness, the research states that an individual needs to have the ability to cognitively recognise the most beneficial information, knowledge, recognised networks, capabilities, and experts so as to capture an idea. There is no standard description of such an individual, and it varies considerably based on their previous experience and personal maturity as an expert (Ardichvili et al., 2003). Given this, the paper investigates antecedents as bundles of attributes that represent entrepreneurial alertness. In this paper, we contribute the antecedent of entrepreneurial zealousness as "the ability to enquire about new areas with openness to experiences" even though disadvantage and limited knowledge may be present. Similarly, the paper presents the antecedent of synergy that explains "the ability to avoid duplication and use an idea, resource, or an advantage to its full capacity". In this paper, the antecedent of synergy is used to optimise the newly-merged port authority to avoid duplication of strategy and to avoid preventable competition. In addition, the paper contributes adaptive mental framework as an antecedent as the ability to 'think outside the box'. This paper states that adaptive mental framework encourages individuals – or in our case port authorities – to be unique, initiative, and inventive with recognising opportunities.

Figure (11) illustrates that entrepreneurial alertness contributes to outcomes such as value sought, value captured, new opportunity, and value void. Entrepreneurial zealousness antecedents are characterised by the actions and processes that port authority undertake to find opportunities that lead to value sought. This paper contributes entrepreneurial zealousness as an antecedent of entrepreneurial alertness, stating that the level of alertness rises with the presence of this antecedent. This study shows that zealousness contributes to the pathway of recognising opportunities, and that capture value arises from successful reconfiguration of the organisation, and can also contribute to creating new business opportunities from the field-specific knowledge gained from previous successful value capture. The absence of zealousness also highlights opportunity lost due to lack of openness to new experiences and in remaining stationary. Extreme risk aversion also plays a role in nullifying the essence of zealousness, creating a value void for the port authority. This paper accepts that some risk averse attitudes stemmed from the previous experience of port authorities and their prior knowledge. Therefore, this contributes to the understanding that an antecedent can also contribute to a negative effect or that it can be the reason for the absence of another antecedent. This paper believes that openness to experience can counter the risk aversion acquired from previous experiences. This, therefore, supports unlearning of assumptions. Similarly, the antecedent of synergy understands the potential of multiple ideas or the advantages of a resource, and how they can be optimised to support, rather than counter, each other's qualities. This, therefore, recognises the opportunities for capture value from 'synergy'. In this paper, the antecedent to synergy generally follows the antecedent to entrepreneurial zealousness.

- *Prior knowledge*

Prior knowledge facilitates the potential of an individual to perceive current knowledge based on their past knowledge experience (Shane, 2000). Prior knowledge has been understood as a cognitive function of translating and storing information that is used to recognise opportunity. It refers the whole knowledge base of a individual's past. Collectively, this individual's prior knowledge may be industry-specific or culture-specific, with the specific from this work experience creating a pathway for management to recognise opportunity and capture value. Consequently, the paper investigates antecedents as bundles of attributes that represent prior knowledge. In this paper, we contribute the antecedent of deliberate searching, access to knowledge and scanning for information. These antecedents achieve the outcome of value sought and new opportunity. The antecedent of deliberate scanning provides port authorities with insights into markets that had not previously been considered for business or potential customers. Similarly, industry-specific 'access to knowledge' provides an advantage in connecting to the right port user in the network. Scanning for information provides the port authority with the opportunity to actively talk to their old customers, learn from their mistakes, and gather feedback information that could provide new opportunities and outcomes. With respect to culture-specific knowledge, past experiences in dealing with international customers can provide assistance in gathering information and insights for new opportunities.

- *Network Ties*

Network Ties consist of business relationships or connections between different network actors from different firms. Network-based opportunities are verified not only by the individual but also by the business and social network in which it exists (Arenius & Clercq, 2005; Bhagavatula et al., 2010; Davidsson & Honig, 2003; MA et al., 2011; Ozgen & Baron, 2007). Network ties do not come into existence naturally. Researchers have argued that crafting network ties represents the proactive development of connections, consistently nurturing them with consistency and trusting them to achieve value capture (Semrau & Sigmund, 2012; Stuart & Sorenson, 2007). Consequently, this paper investigates antecedents as bundles of attributes that represent network ties. In this paper we contribute the antecedent of interpersonal trust and autonomy. Interpersonal trust is an antecedent needed in the context of a highly dense network where the one who holds the information holds the power. In the port authority context, most of the information is held by the agents, hence making them a powerful entity in the network. It is crucial that there is a high level of interpersonal trust with agents so that the port authority can optimally use their new form of governance structure. If there is an absence of interpersonal trust, this will create mistrust amongst the agents. This can result in the port authority decreasing the information accessibility within the network, eventually contributing to value void. Autonomy is an antecedent that provides the port authority with optimal use of the new governance structure. However, if there is an absence of interpersonal trust in the network, the autonomy antecedent will not provide the outcome of value captured or assist in recognising any new opportunities.

- *Personality traits*

Personality traits encompass a high level of intelligence and creativity, and far less fear of failure (Ardichvili et al., 2003; Baron, 2007; Gonzalez-Alvarez & Solis-Rodriguez, 2011; Li, 2013). Most of the antecedents are discussed in how cognitive intelligence and individuals' psychology are assembled to recognise the higher picture, with the aim being to achieve goals and set precedence in the environment in which they work. This paper takes personality traits into consideration to study the cognitive process through which port authorities recognise opportunity. In this paper, we contribute the antecedent of change mentality, mindfulness of learning and self-correction. The attribute of 'change mentality' is explained as the 'ability of an individual or a firm to strive for change even though the environment it exists in is constant'. Moreover, change mentality means that individuals and firms are ready for any new development, and strive for the best possible outcome. Similarly, this paper presents the antecedent of mindfulness of learning as the 'ability of an individual or a firm to be aware of the impact the changes have on the internal employees, business environment and other externalities.'

In addition, it is important to be reflexive enough to learn about these differences. The antecedent of self-correction is defined as the ability to be conscious of the risk, challenges and uncertainties present due to the recognition of a new opportunity. In this paper, the antecedent of change mentality is recognised as one of the qualities held by committee members responsible for the merger of the port authorities in the Port of Haminakotka, the Port of ADP and the Port of Kvarken. These members were open to discovering the advantages offered by the merging of the two ports in order to capture value and create new opportunity. In addition, the paper contributes the antecedent of open mindedness, which influences management to understand the similarities and differences of the cultures of their customers (i.e. port users and their associations) in Russia and Kazakhstan. On the contrary, these attributes were absent in the traits of some of the individuals recruited in the port of Kvarken following the merger of the two port authorities. This absence can be seen as a contributor to value void. In addition, the paper contributes the attribute of 'self-correction', which provides the port authority with greater awareness towards risk when recognising new opportunities. The 'self-correction' ability also provides support to individuals and management to learn from their mistakes and to rectify them to achieve value sought.

In summary, this paper presents the term entrepreneurial zealousness to encompass the traits of entrepreneurial alertness as well as the creativity of the personality and the inquisitiveness of experiencing newness in the quest to recognise opportunity. This paper states that the existence of entrepreneurial zealousness is essential for the successful outcome of recognising new opportunities. To evade an outcome like value void, it is essential to invest time in nurturing the antecedents of entrepreneurial zealousness, interpersonal trust, and autonomy. This paper argues that the higher the existence of these antecedents, the greater to the contribution to a wide selection of business-like opportunities.

11. LIMITATIONS

This paper studies the newly-merged Port of Haminakotka, the Port of Kvarken and the Port of ADP. The aim of this paper is to examine case studies, and to study the transition from opportunity to strategy. We were limited in our case selection due to the recentness of the port's merged status as well as the fact that the top management had only just been recruited. This was the case especially in the Port of ADP and the Port of Kvarken. Due to these two factors, the paper faced a dilemma of limited case studies; however, analysing these case studies and recognising that the management had only been in post a short time gave us insights into their processes of recognising strategies, and how they saw the ports from this new perspective. In addition, the paper focused on the antecedents which existed only in the port authority, and studied the interactions with port users and port associations. For future research, it would be interesting to conduct a follow up on these ports' authorities and their current management teams, and to compare the changes between present and past antecedents in terms of recognising new opportunities.

NOTES

Appendix 1: Factors that determine the Opportunity Recognition

Factors that determine the opportunity recognition	*Author*
Alertness	
	Ardichvili and Cardozo, 2000
	Gaglio and Katz, 2001
	Archichvili et al., 2003
	Gaglio, 2004
	Baron, 2006
	Sambasivan, Abdul and Yusop, 2009
	Garcia-Cabrera and Garcia-Soto, 2009
	Webb, Ireland, Hitt, Kistruck, and Tihanyi, 2011
	Hulbert, Gilmore, and Carson, 2013
	George Parida, Lahti and Wincent, 2016
	Hulbert et al., 2015

	Lim and Xavier, 2015
	Kohlbacker, Herstatt and Levensen, 2015
	De Jong and Marsili, 2015
	Barringer and Ireland, 2016
	Kuckertz, Kollmann, Krell and Stockmann, 2017
	Veilleux, Haskell and Beliveau, 2018
Prior Knowledge	Ardichvili and Cardozo, 2000
	Shane and Venkataraman, 2000
	Shane, 2000
	Ardichvili et al., 2003
	Gaglio, 2004
	Macpherson, Jones, and Zhang, 2004
	Shepherd and De tienne, 2005
	Park, 2005
	Baron, 2006
	Peach and Cameron, 2006
	McMullen & Shepherd ,2006
	Franzoni, 2007
	Garcia-Cabrera and Garcia-Soto, 2009
	Tang, 2010
	Marvel and Droege, 2010
	Ramos-Rodriguez, Medina-Garrido, Lorenzo-Gomez and Ruiz-Navarro, 2010
	Patzelt and Shepherd, 2011
	Webb, Ireland, Hitt, Kistruck and Tihanyi, 2011
	Mueller and Shepherd, 2012
	Hubert, Gilmore and Carson, 2013
	Wang et al., 2013
	George, Parida, Lahti and Wincent, 2016
	Hulbert et al., 2015
	Lim and Xavier, 2015
	Kohlbacher, Herstatt and Levesen, 2015
	Bloodgood, Hornsby, Burkemper, and Sarooghi, 2015
	Barringer and Ireland, 2016
	Kuckertz, Kollmann, Krell, and Stockmann, 2017
	Veilleux, Haskell, and Beliveau, 2018

Network Ties	Ardichvili and Cardozo, 2000
	Archichvili et al., 2003
	Davidsson and Honig, 2003
	Macpherson, Jones, and Zhang, 2004
	Lumpkin, Hills and Shrader, 2004
	Arenius and De Clercq, 2005
	Baron, 2006
	Franzoni, 2007
	Tang, 2010
	Ramos-Rodriguez, Medina-Garrido, Lorenzo-Gomez and Ruiz-Navarro, 2010
	Bhagavatula et al., 2010
	Webb, Ireland, Hitt, Kistruck and Tihanyi, 2011
	Wang et al., 2013
	George, Parida, Lahti and Wincent ,2016
	Lim and Xavier, 2015
	Barringer and Ireland, 2016
	Veilleux, Haskell, and Beliveau, 2018
Personality Traits	Shane and Venkataraman, 2000
	Sinclair and D'Souza, 2011
	George, Parida, Lahti and Wincent, 2016
	Bloodgood, Hornsby, Burkemper, and Sarooghi, 2015

Appendix 2:List of Codes

List of codes	Files	References
Alertness	14	876
Adaptative mental framework	14	207
Association and Connection	14	344
Difference influences	14	12
Environmental experience	14	203
Evaluation and Judgement	14	16
Knowledge search	14	0
Interaction with complementary background	14	203
New imitator	14	0

Non-*Alert* Individual	14	3
Openness to experience	14	203
Make connection	14	203
Imagination	14	203
Open Mindedness	14	203
Scanning Search	14	0
Self-Purposefulness	14	203
Temporary monopoly power	14	203
Autonomy	14	711
Collaborated Port	14	440
Digitalisation	14	41
Institution Port	14	2
Managerial Coopetition	14	876
Network Embeddedness	14	213
Prior Knowledge	14	54
access to knowledge	14	0
Education social context	14	0
Entrepreneurial Learning	14	51
customer problem	14	0
Lack of Knowledge and Skills	14	51
Ways to serve the market	14	8
experience in opportunity recognition	14	211
Greater Managerial capabilities	14	18
customer demand for the new product	14	6
greater managerial capability	14	8
Human Information Processing	14	6
Influence of the environment in the development of knowledge	14	81
Information acquisition	14	51
knowledge spillovers	14	1
specialized knowledge	14	80
Personality Traits	14	8
pervious experience	14	120
Previous knowledge	14	120
Prior Knowledge of Market	14	121
Problem solving.	14	34
Resource Mobilisation	14	0
Role of alertness	14	203
satisfied unmet needs	14	0
self-efficacy	14	30
education, and work experience,	14	0
Network Ties	14	171
Deliberate searching	14	20
Environmental certainty	14	41
Information search Channel	14	2
Personal Initiative	14	77
Reported behaviour	14	0
Search for information channel	14	154
Search for informational cues	14	33
Search strategy for opportunity	14	88
Interpersonal Trust	14	119
Value sought	14	40
Enactment	14	2

Problem solving	14	68
Overarching	14	3
Value Void	14	65
Complex scenarios	14	4
Divergent thinking skills	14	22

Appendix 3: List of References used for coding (Excluding Paper Reference)

Ardichvili, A., Cardozo, R.N., 2000. A model of the entrepreneurial opportunity recognition process. J. Enterprising Cult. 8 (2), 103–119.

Ardichvili, A., Cardozo, R., Ray, S., 2003. A theory of entrepreneurial opportunity identification and development. J. Bus. Ventur. 18 (1), 105–123.

Arenius, P., De Clercq, D., 2005. A network-based approach on opportunity recognition.Small Bus. Econ. 24 (3), 249–265.

Baron, R.A., 2006. Opportunity recognition as pattern recognition: how entrepreneurs "connect the dots" to identify new business opportunities. Acad. Manag. Perspect. 20 (1), 104–119.

Baron, R.A., 2008. The role of affect in the entrepreneurial process. Acad. Manage. Rev.33 (2), 328–340.

Barringer, B.R., Ireland, R.D., 2016. Entrepreneurship: Successfully Launching New Ventures, 5th ed. Pearson Education, Boston.

Bhagavatula, S., Elfring, T., van Tilburg, A., van de Bunt, G.G., 2010. How social and human capital influence opportunity recognition and resource mobilization in India's handloom industry. J. Bus. Ventur. 25 (3), 245–260.

Bloodgood, J.M., Hornsby, J.S., Burkemper, A.C., Sarooghi, H., 2015. A system dynamics perspective of corporate entrepreneurship. Small Bus. Econ. 45 (2), 383–402. Brooks, J., McCluskey, S., Turley, E., King, N., 2015. The utility of template analysis in qualitative psychology research. Qual. Res. Psychol. 12 (2), 202–222.

Davidsson, P., Honig, B., 2003. The role of social and human capital among nascent entrepreneurs. J. Bus. Ventur. 18 (3), 301–331.

de Araujo Ruiz, S.M., Martens, C.D.P., da Costa, P.R., 2020. Entrepreneurial university: an exploratory model for higher education. Journal of Management Development 39(5), 705–722.

de Jong, J.P.J., Marsili, O., 2015. The distribution of Schumpeterian and Kirznerian opportunities. Small Bus. Econ. 44 (1), 19–35.

Faroque, A.R., Morrish, S.C., Kuivalainen, O., Sundqvist, S., Torkkeli, L., 2020.

Microfoundations of network exploration and exploitation capabilities in international opportunity recognition. Int. Bus. Rev., 101767

Franzoni, C., 2007. Opportunity recognition in technology transfer organizations: five case studies from UK and Italy. Int. Entrep. Manag. J. 3 (1), 51–67.

Gaglio, C.M., 2004. The role of mental simulations and counterfactual thinking in the opportunity identification process*. Entrep. Theory Pract. 28 (6), 533–552.

Gaglio, C.M., Katz, J.A., 2001. The Psychological Basis of Opportunity Identification: entrepreneurial Alertness. Small Bus. Econ. 16 (2), 95–111.

García-Cabrera, A.M., García-Soto, M.G., 2009. A dynamic model of technology-based opportunity recognition. J. Entrep. 18 (2), 167–190.

George, N.M., Parida, V., Lahti, T., Wincent, J., 2016. A systematic literature review of entrepreneurial opportunity recognition: insights on influencing factors. Int. Entrep. Manag. J. 12 (2), 309–350.

Hulbert, B., Gilmore, A., Carson, D., 2013. Sources of opportunities used by growth minded owner managers of small and medium sized enterprises. Int. Bus. Rev. 22(1), 293–303.

Hulbert, B., Gilmore, A., Carson, D., 2015. Opportunity recognition by growing SMEs: a managerial or entrepreneurial function? J. Strateg. Manag. 23 (7), 616–642

Kohlbacher, F., Herstatt, C., Levsen, N., 2015. Golden opportunities for silver innovation: how demographic changes give rise to entrepreneurial opportunities to meet the needs of older people. Technovation 39-40 (39/40), 73–82.

Kuckertz, A., Kollmann, T., Krell, P., St¨ockmann, C., 2017. Understanding, differentiating, and measuring opportunity recognition and opportunity exploitation. Int. J. Entrep. Behav. Res. 23 (1), 78–97.

Lincoln, Y.S., Guba, E.G., 1985. Naturalistic Inquiry. SAGE, California.

Lumpkin, G.T., Hills, G.E., Shrader, R.C., 2004. Opportunity recognition. In: Welsch, H.P.(Ed.), Entrepreneurship: The way Ahead. Routledge (pp. 70-30).

Macpherson, A., Jones, O., Zhang, M., 2004. Evolution or revolution? Dynamic capabilities in a knowledge-dependent firm. R&D Management 34 (2), 161–177.

Marvel, M.R., Droege, S., 2010. Prior tacit knowledge and first-year sales: learning from technology entrepreneurs. J. Small Bus. Enterp. Dev. 17 (1), 32–44.

McMullen, J.S., Shepherd, D.A., 2006. Entrepreneurial action and the role of uncertainty in the theory of the entrepreneur. Acad. Manag. Rev. 31 (1), 132–152.

Mueller, B., Shepherd, D.A., 2012. Learning from Failure: how Entrepreneurial Failure Aids in the Development of Opportunity Recognition Expertise. Frontiers of Entrepreneurship Research 32 (6), 6.

Park, J.S., 2005. Opportunity recognition and product innovation in entrepreneurial hi-tech start-ups: a new perspective and supporting case study. Technovation 25 (7), 739–752.

Patzelt, H., Shepherd, D.A., 2011. Recognizing opportunities for sustainable development. Entrep. Theory Pract. 35 (4), 631–652.

Pech, R.J., Cameron, A., 2006. An entrepreneurial decision process model describing opportunity recognition. Eur. J. Innov. Manag. 9 (1), 61–78.

Ramos-Rodríguez, A.-.R., Medina-Garrido, J.-.A., Lorenzo-G´omez, J.-.D., RuizNavarro, J., 2010. What you know or who you know? The role of intellectual and social capital in opportunity recognition. Int. Small Bus. J. 28 (6), 566–582.

Rauch, A., Fink, M., Hatak, I., 2018. Stress processes: an essential ingredient in the entrepreneurial process. Acad. Manag. Perspect. 32 (3), 340–357.

Sambasivan, M., Abdul, M., Yusop, Y., 2009. Impact of personal qualities and management skills of entrepreneurs on venture performance in Malaysia: opportunity recognition skills as a mediating factor. Technovation 29 (11), 798–805.

Shane, S., 2000. Prior Knowledge and the Discovery of Entrepreneurial opportunities.Organ. Sci. 11 (4), 448–469.

Shane, S., Venkataraman, S., 2000. The promise of entrepreneurship as a field of research. Acad. Manage. Rev. 25 (1), 217–226.

Shepherd, D.A., DeTienne, D.R., 2005. Prior knowledge, potential financial reward, and opportunity identification. Entrep. Theory Pract. 29 (1), 91–112.

Sinclair, R.F., D'Souza, R.R, 2011. An examination of the effect of situational awareness on opportunity recognition (Summary). Front. Entrep. Res. 31 (6), 12.

Tang, J., 2010. How entrepreneurs discover opportunities in China: an institutional view.

Asia Pac. J. Manag. 27 (3), 461–479.

Veilleux, S., Haskell, N., B´eliveau, D., 2018. Opportunity recognition by international high-technology start-up and growth photonics firms. Int. J. Entrep. Innov. Manag. 22 (1–2), 126–151.

Wang, Y.-.L., Ellinger, A.D., Jim Wu, Y.-.C., 2013. Entrepreneurial opportunity recognition: an empirical study of R&D personnel. Manag. Dec. 51 (2), 248–266

Webb, J.W., Ireland, R.D., Hitt, M.A., Kistruck, G.M., Tihanyi, L., 2011. Where is the opportunity without the customer? An integration of marketing activities, the entrepreneurship process, and institutional theory. Acad. Mark. Sci. Rev. 39 (4), 537–554.

BIBLIOGRAPHY

Ardichvili, A., Cardozo, R., & Ray, S. (2003). *A theory of entrepreneurial opportunity identification and development*. 1–19. https://doi.org/10.1016/s0883-9026(01)00068-4

Arenius, P., & Clercq, D. D. (2005). A network-based approach on opportunity recognition. *Small Business Economics*. http://link.springer.com/article/10.1007/s11187-005-1988-6

Arentz, J., Sautet, F., & Storr, V. (2012). Prior-knowledge and opportunity identification. *Small Business Economics*, *41*(2), 461–478. https://doi.org/10.1007/s11187-012-9437-9

Axelsson, B., & Easton, G. (2016). *Industrial Networks (Routledge Revivals)*. https://doi.org/10.4324/9781315629629

Baltazar, R., & Brooks, M. R. (2006). Chapter 17 Port Governance, Devolution and the Matching Framework: A Configuration Theory Approach. *Research in Transportation Economics*, *17*, 379–403. https://doi.org/10.1016/s0739-8859(06)17017-1

Baron, R. A. (2007). Behavioral and cognitive factors in entrepreneurship: entrepreneurs as the active element in new venture creation. *Strategic Entrepreneurship Journal*, *1*(1-2), 167–182. https://doi.org/10.1002/sej.12

Berg, R. V. den, & Langen, P. W. D. (2011). Hinterland strategies of port authorities: A case study of the port of Barcelona. *Research in Transportation Economics*, *33*(1), 6–14. https://doi.org/10.1016/j.retrec.2011.08.002

Berg, R. V. den, Langen, P. W. D., & Costa, C. R. (2012). The role of port authorities in new intermodal service development; the case of Barcelona Port Authority. *Research in Transportation Business & Management*, *5*(C), 78–84. https://doi.org/10.1016/j.rtbm.2012.11.003

Bhagavatula, S., Elfring, T., Tilburg, A. van, & Bunt, G. G. van de. (2010). How social and human capital influence opportunity recognition and resource mobilization in India's handloom industry. *Journal of Business Venturing*, *25*(3), 245–260. https://doi.org/10.1016/j.jbusvent.2008.10.006

Bichou, K., & Gray, R. (2004). A logistics and supply chain management approach to port performance measurement. *Maritime Policy & Management*, *31*(1), 47–67. https://doi.org/10.1080/0308883032000174454

Brooks, M. R., & Cullinane, K. (2006). Chapter 18 Governance Models Defined. *Research in Transportation Economics*, *17*, 405–435. https://doi.org/10.1016/s0739-8859(06)17018-3

Cahoon, S., Pateman, H., & Chen, S.-L. (2013). Regional port authorities: leading players in innovation networks? *Journal of Transport Geography*, *27*(C), 66–75. https://doi.org/10.1016/j.jtrangeo.2012.06.015

Chan, K.-Y., Uy, M. A., Chernyshenko, O. S., Ho, M.-H. R., & Sam, Y.-L. (2015). Personality and entrepreneurial, professional and leadership motivations. *Personality and Individual Differences*, *77*, 161–166. https://doi.org/10.1016/j.paid.2014.12.063

Chavoushi, Z. H., Zali, M. R., Valliere, D., Faghih, N., Hejazi, R., & Dehkordi, A. M. (2020). Entrepreneurial alertness: a systematic literature review. *Journal of Small Business & Entrepreneurship*, *33*(2), 1–30. https://doi.org/10.1080/08276331.2020.1764736

Cohen, W. M., & Levinthal, D. A. (1990). Absorptive Capacity: A New Perspective on Learning and Innovation. *Administrative Science Quarterly*, *35*(1), 128. https://doi.org/10.2307/2393553

Coto-Millán, P., Fernández, X. L., Hidalgo, S., & Pesquera, M. Á. (2016). Public regulation and technical efficiency in the Spanish Port Authorities_ 1986–2012. *Transport Policy*, *47*(C), 139–148. https://doi.org/10.1016/j.tranpol.2016.01.006

Davidsson, P., & Honig, B. (2003). The role of social and human capital among nascent entrepreneurs. *Journal of Business Venturing*, *18*(3), 301–331. https://doi.org/10.1016/s0883-9026(02)00097-6

Denktas-Sakar, G., & Karatas-Cetin, C. (2013). *Port Sustainability and Stakeholder Management in Supply Chains: A Framework on Resource Dependence Theory*. *28*(3), 301–319. https://doi.org/10.1016/j.ajsl.2013.01.002

Dinwoodie, J., Tuck, S., Knowles, H., Benhin, J., & Sansom, M. (2011). Sustainable Development of Maritime Operations in Ports. *Business Strategy and the Environment*, *21*(2), 111–126. https://doi.org/10.1002/bse.718

Dögl, C., Holtbrügge, D., & Schuster, T. (2012). Competitive advantage of German renewable energy firms in India and China. *International Journal of Emerging Markets*, *7*(2), 191–214. https://doi.org/10.1108/17468801211209956

Dooms, M., Lugt, L. van der, & Langen, P. W. D. (2013). International strategies of port authorities: The case of the Port of Rotterdam Authority. *Research in Transportation Business & Management*, *8*(C), 148–157. https://doi.org/10.1016/j.rtbm.2013.06.004

Dooms, M., Verbeke, A., & Haezendonck, E. (2013). Stakeholder management and path dependence in large-scale transport infrastructure development: the port of Antwerp case

(1960â€"2010). *Journal of Transport Geography*, *27*(C), 14–25. https://doi.org/10.1016/j.jtrangeo.2012.06.002

Eisenhardt, K. M. (1989). Building theories from case study research. *Academy of Management Review*, *14*(4), 532–550.

Ferrari, C., Parola, F., & Gattorna, E. (2011). Measuring the quality of port hinterland accessibility The Ligurian case. *Transport Policy*, *18*(2), 382–391. https://doi.org/10.1016/j.tranpol.2010.11.002

Foo, M. (2011). Emotions and Entrepreneurial Opportunity Evaluation. *Entrepreneurship Theory and Practice*, *35*(2), 375–393. https://doi.org/10.1111/j.1540-6520.2009.00357.x

Fremont, A., & Lavaud-Letilleul., V. (2009). Rethinking proximity: New opportunities for port development. The case of Dunkirk. *Port in Proximity Competition and Coordination among Adjacent Seaports*. https://doi.org/10.4324/9781315601564-22

Gaglio, C. M., & Katz, J. A. (2001). The Psychological Basis of Opportunity Identification: Entrepreneurial Alertness. *Small Business Economics*, *16*(2), 95–111. https://doi.org/10.1023/a:1011132102464

García-Cabrera, A. M., & García-Soto, M. G. (2009). A Dynamic Model of Technology-based Opportunity Recognition. *The Journal of Entrepreneurship*, *18*(2), 167–190. https://doi.org/10.1177/097135570901800202

Gonzalez-Alvarez, N., & Solis-Rodriguez, V. (2011). Discovery of entrepreneurial opportunities: a gender perspective. *Industrial Management & Data Systems*, *111*(5), 755–775. https://doi.org/10.1108/02635571111137296

Gordon, J. M., & Schaller, T. K. (2014). The role of mindfulness in entrepreneurial market analysis. *Journal of Research in Marketing and Entrepreneurship*, *16*(1), 7–25. https://doi.org/10.1108/jrme-02-2013-0005

Goss, R. O. (1990a). Economic policies and seaports: Strategies for port authorities. *Maritime Policy & Management*, *17*(4), 273–287.

Goss, R. O. (1990b). Economic policies and seaports: The diversity of port policies. *Maritime Policy & Management*, *17*(3), 221–234. https://doi.org/10.1080/03088839000000029

Goss, R. O. (1990c). Economic policies and seaports: The economic functions of seaports. *Maritime Policy & Management*, *17*(3), 207–219. https://doi.org/10.1080/03088839000000028

Guo, L., Ng, A. K. Y., Jiang, C., & Long, J. (2021). Stepwise capacity integration in port cluster under uncertainty and congestion. *Transport Policy*, *112*, 94–113. https://doi.org/10.1016/j.tranpol.2021.08.011

Hall, P. V., & Jacobs, W. (2009). Shifting Proximities: The Maritime Ports Sector in an Era of Global Supply Chains. *Regional Studies*, *44*(9), 1103–1115. https://doi.org/10.1080/00343400903365110

Hayek, F. A. (1945). Time-Preference and Productivity: A Reconsideration. *Economica*, *12*(45), 22. https://doi.org/10.2307/2550247

Heaver, T., Meersman, H., Moglia, F., & Voorde, E. V. D. (2000). Do mergers and alliances influence European shipping and port competition? *Maritime Policy & Management*, *27*(4), 363–373. https://doi.org/10.1080/030888300416559

Heaver, T., Meersman, H., & Voorde, E. V. D. (2001). Co-operation and competition in international container transport: strategies for ports. *Maritime Policy & Management*, *28*(3), 293–305. https://doi.org/10.1080/03088830110055693

Hill, C. W. L., & Jones, T. M. (1992). STAKEHOLDER-AGENCY THEORY. *Journal of Management Studies*, *29*(2), 131–154. https://doi.org/10.1111/j.1467-6486.1992.tb00657.x

Hitt, M. A., Ireland, R. D., Sirmon, D. G., & Trahms, C. A. (2001). Strategic Entrepreneurship: Creating Value for Individuals, Organizations, and Society. *SSRN Electronic Journal*, 1–20. https://doi.org/10.2139/ssrn.1994491

Hollen, R. M. A., Bosch, F. A. J. V. D., & Volberda, H. W. (2014). *Strategic levers of port authorities for industrial ecosystem development*. *17*(1), 79–96. https://doi.org/10.1057/mel.2014.28

Horst, M. R. V. D., & Langen, P. W. D. (2008). Coordination in Hinterland Transport Chains: A Major Challenge for the Seaport Community. *Maritime Economics & Logistics*, *10*(1–2), 108–129. https://doi.org/10.1057/palgrave.mel.9100194

Hoshino, H. (2010). Competition and Collaboration among Container Ports. *The Asian Journal of Shipping and Logistics*, *26*(1), 31–47. https://doi.org/10.1016/s2092-5212(10)80010-0

Hsueh, J.-T., Lin, N.-P., & Li, H.-C. (2010). The effects of network embeddedness on service innovation performance. *The Service Industries Journal*, *30*(10), 1723–1736. https://doi.org/10.1080/02642060903100398

Huo, W., Zhang, W., & Chen, P. S.-L. (2018). Recent development of Chinese port cooperation strategies. *Research in Transportation Business & Management*, *26*, 67–75. https://doi.org/10.1016/j.rtbm.2018.01.002

Ireland, R. D., Hitt, M. A., Camp, S. M., & Sexton, D. L. (2001). Integrating entrepreneurship and strategic management actions to create firm wealth. *Academy of Management Perspectives*, *15*(1), 49–63. https://doi.org/10.5465/ame.2001.4251393

JACOBS, W. (2007). PORT COMPETITION BETWEEN LOS ANGELES and LONG BEACH: AN INSTITUTIONAL ANALYSIS. *Tijdschrift Voor Economische En Sociale Geografie*, *98*(3), 360–372. https://doi.org/10.1111/j.1467-9663.2007.00403.x

Johanson, J., & Vahlne, J.-E. (2003). Business Relationship Learning and Commitment in the Internationalization Process. *Journal of International Entrepreneurship*, *1*(1), 83–101. https://doi.org/10.1023/a:1023219207042

Kedmenec, I., Tominc, P., & Rebernik, M. (2014). Gender differences in the usage of resources in the entrepreneurial opportunity identification process in Slovenia and Croatia. *Economic Research-Ekonomska Istraživanja*, *27*(1), 366–377. https://doi.org/10.1080/1331677x.2014.966973

Kelly, L., & Dorian, M. (2017). Doing Well and Good: An Exploration of the Role of Mindfulness in the Entrepreneurial Opportunity Recognition and Evaluation Process. *New England Journal of Entrepreneurship*, *20*(2), 26–36. https://doi.org/10.1108/neje-20-02-2017-b002

Kickul, J., & Gundry, L. (2002). Prospecting for Strategic Advantage: The Proactive Entrepreneurial Personality and Small Firm Innovation. *Journal of Small Business Management*, *40*(2), 85–97. https://doi.org/10.1111/1540-627x.00042

Kickul, J., Gundry, L. K., Barbosa, S. D., & Whitcanack, L. (2009). Intuition versus Analysis? Testing Differential Models of Cognitive Style on Entrepreneurial Self–Efficacy and the New Venture Creation Process. *Entrepreneurship Theory and Practice*, *33*(2), 439–453. https://doi.org/10.1111/j.1540-6520.2009.00298.x

Kickul, J., & Lyons, T. S. (2020). *Understanding Social Entrepreneurship*. https://doi.org/10.4324/9780429270406

Kirzner, I. M. (1973). *Competition and Entrepreneurship*. https://doi.org/10.7208/chicago/9780226375489.001.0001

Kontinen, T., & Ojala, A. (2011a). International Opportunity Recognition among Small and Medium-Sized Family Firms*. *Journal of Small Business Management*, *49*(3), 490–514. https://doi.org/10.1111/j.1540-627x.2011.00326.x

Kontinen, T., & Ojala, A. (2011b). Network ties in the international opportunity recognition of family SMEs. *International Business Review*, *20*(4), 440–453. https://doi.org/10.1016/j.ibusrev.2010.08.002

Korsgaard, S., Berglund, H., Thrane, C., & Blenker, P. (2016). A Tale of Two Kirzners: Time, Uncertainty, and the "Nature" of Opportunities. *Entrepreneurship Theory and Practice*, *40*(4), 867–889. https://doi.org/10.1111/etap.12151

Langen, D., & Nijdam, M. H. (2009). A best practice in cross-border cooperation: Copenhagen... - Google Scholar. *Transport and Mobility Series*. https://scholar.google.com/scholar?q=A+best+practice+in+cross-border+cooperation%3A+Copenhagen+Malm%C3%B6+Port

Langen, P. W. D. (2005). Trends and Opportunities for the Long-Term Development of Rotterdam's Port Complex. *Coastal Management*, *33*(2), 215–224. https://doi.org/10.1080/08920750590919691

Langen, P. W. D. (2006). Chapter 20 Stakeholders, Conflicting Interests and Governance in Port Clusters. *Research in Transportation Economics*, *17*, 457–477. https://doi.org/10.1016/s0739-8859(06)17020-1

Langen, P. W. D., & Heij, C. (2014). Corporatisation and Performance: A Literature Review and an Analysis of the Performance Effects of the Corporatisation of Port of Rotterdam Authority. *Transport Reviews*, *34*(3), 396–414. https://doi.org/10.1080/01441647.2014.905650

Lanivich, S. E., Smith, A., Levasseur, L., Pidduck, R. J., Busenitz, L., & Tang, J. (2022). Advancing entrepreneurial alertness: Review, synthesis, and future research directions. *Journal of Business Research*, *139*, 1165–1176. https://doi.org/10.1016/j.jbusres.2021.10.023

Lenney, P., & Easton, G. (2009). Actors, resources, activities and commitments. *Industrial Marketing Management*, *38*(5), 553–561. https://doi.org/10.1016/j.indmarman.2008.12.020

Li, Z. (2013). *Entrepreneurial Alertness, An Exploratory Study*. https://doi.org/10.1007/978-3-642-31098-0

Lugt, L. V. der, Langen, P. D., & Hagdorn, L. (2015). Beyond the landlord: worldwide empirical analysis of port authority strategies. *International Journal of Shipping and Transport Logistics*, *7*(5), 570. https://doi.org/10.1504/ijstl.2015.072021

Lugt, L. van der, Dooms, M., & Parola, F. (2013). Strategy making by hybrid organizations: The case of the port authority. *Research in Transportation Business & Management*, *8*(C), 103–113. https://doi.org/10.1016/j.rtbm.2013.06.005

Lugt, L. M. van der, Langen, P. W. de, & Hagdorn, L. (2017). Strategic beliefs of port authorities. *Transport Reviews*, *37*(4), 412–441. https://doi.org/10.1080/01441647.2016.1245685

MA, R., Huang, Y., & Shenkar, O. (2011). Social networks and opportunity recognition: A cultural comparison between Taiwan and the United States. *Strategic Management Journal*, *32*(11), 1183–1205. https://doi.org/10.1002/smj.933

Marschan-Piekkari, R., & Welch, C. (2004). Qualitative research methods in international business: The state of the art. *Handbook of Qualitative Research Methods for International Business*, 5–24.

Miles, M. B., & Huberman, M. A. (1994). *Qualitative data analysis: An expanded sourcebook*.

Ng, A. K. Y., & Pallis, A. A. (2010). Port Governance Reforms in Diversified Institutional Frameworks: Generic Solutions, Implementation Asymmetries. *Environment and Planning A*, *42*(9), 2147–2167. https://doi.org/10.1068/a42514

Notteboom, T. (2006). Chapter 2 Strategic Challenges to Container Ports in a Changing Market Environment. *Research in Transportation Economics*, *17*, 29–52. https://doi.org/10.1016/s0739-8859(06)17002-x

Notteboom, T. E. (2003). Concentration and load centre development in the European container port system. *Journal of Transport Geography*, *5*(2), 99–115. https://doi.org/10.1016/s0966-6923(96)00072-5

Notteboom, T. E., Pallis, A. A., Langen, P. W. D., & Papachristou, A. (2013). Advances in port studies: the contribution of 40 years Maritime Policy & Management. *Maritime Policy & Management*, *40*(7), 636–653. https://doi.org/10.1080/03088839.2013.851455

Notteboom, T. E., & Winkelmans, W. (2001a). Structural changes in logistics: how will port authorities face the challenge? *Maritime Policy & Management*, *28*(1), 71–89. https://doi.org/10.1080/03088830119197

Notteboom, T. E., & Winkelmans, W. (2001b). Reassessing Public Sector Involvement in European Seaports. *International Journal of Maritime Economics*, *3*(2), 242–259. https://doi.org/10.1057/palgrave.ijme.9100008

Obschonka, M., Hakkarainen, K., Lonka, K., & Salmela-Aro, K. (2017). Entrepreneurship as a twenty-first century skill: entrepreneurial alertness and intention in the transition to adulthood. *Small Business Economics*, *48*(3), 487–501. https://doi.org/10.1007/s11187-016-9798-6

Ozgen, E., & Baron, R. A. (2007). Social sources of information in opportunity recognition: Effects of mentors, industry networks, and professional forums. *Journal of Business Venturing*, *22*(2), 174–192. https://doi.org/10.1016/j.jbusvent.2005.12.001

Pallis, A. A., Vitsounis, T. K., Langen, P. W. D., & Notteboom, T. E. (2011). Port Economics, Policy and Management: Content Classification and Survey. *Transport Reviews*, *31*(4), 445–471. https://doi.org/10.1080/01441647.2010.530699

Panayides, P. M., & Song, D.-W. (2013). Maritime logistics as an emerging discipline. *Maritime Policy & Management*, *40*(3), 295–308. https://doi.org/10.1080/03088839.2013.782942

Psaraftis, H. N., & Pallis, A. A. (2012). Concession of the Piraeus container terminal: turbulent times and the quest for competitiveness. *Maritime Policy & Management*, *39*(1), 27–43. https://doi.org/10.1080/03088839.2011.642316

Ramos-Rodríguez, A.-R., Medina-Garrido, J.-A., Lorenzo-Gómez, J.-D., & Ruiz-Navarro, J. (2010). What you know or who you know? The role of intellectual and social capital in opportunity recognition. *International Small Business Journal*, *28*(6), 566–582. https://doi.org/10.1177/0266242610369753

Robinson, R. (2002). Ports as elements in value-driven chain systems: the new paradigm. *Maritime Policy & Management*, *29*(3), 241–255. https://doi.org/10.1080/03088830210132623

Rowley, J. (2002). Using case studies in research. *Management Research News*, *25*(1), 16–27. https://doi.org/10.1108/01409170210782990

Russo, F., & Musolino, G. (2021). Computational Science and Its Applications – ICCSA 2021, 21st International Conference, Cagliari, Italy, September 13–16, 2021, Proceedings, Part X. *Lecture Notes in Computer Science*, 198–212. https://doi.org/10.1007/978-3-030-87016-4_15

Schumpeter, J. A., & Nichol, A. J. (1934). Robinson's Economics of Imperfect Competition. *Journal of Political Economy*, *42*(2), 249–259. https://doi.org/10.1086/254595

Semrau, T., & Sigmund, S. (2012). Networking Ability and the Financial Performance of New Ventures: A Mediation Analysis among Younger and More Mature Firms. *Strategic Entrepreneurship Journal*, *6*(4), 335–354. https://doi.org/10.1002/sej.1146

Shane, S. (2000). Prior Knowledge and the Discovery of Entrepreneurial Opportunities. *Organization Science*, *11*(4), 448. JSTOR. http://www.jstor.org/stable/2640414

Shane, S., & Venkataraman, S. (1996). Renegade and Rational Championing Strategies. *Organization Studies*, *17*(5), 751–771. https://doi.org/10.1177/017084069601700503

Shane, S., & Venkataraman, S. (2001). Entrepreneurship As a Field of Research: A Response to Zahra and Dess, Singh, and Erikson. *Academy of Management Review*, *26*(1), 13–16. https://doi.org/10.5465/amr.2001.27879269

Shane, S., Venkataraman, S., & MacMillan, I. (1995). Cultural differences in innovation championing strategies. *Journal of Management*, *21*(5), 931–952. https://doi.org/10.1016/0149-2063(95)90048-9

Slack, B., Comtois, C., & McCalla, R. (2002). Strategic alliances in the container shipping industry: a global perspective. *Maritime Policy & Management*, *29*(1), 65–76. https://doi.org/10.1080/03088830110063694

Song, D.-P., Lyons, A., Li, D., & Sharifi, H. (2016). *Modeling port competition from a transport chain perspective*. 1–22. https://doi.org/10.1016/j.tre.2016.01.001

Song, D.-W. (2010). Port co-opetition in concept and practice. *Maritime Policy & Management*, *30*(1), 29–44. https://doi.org/10.1080/0308883032000051612

Song, D.-W., Cheon, S., & Pire, C. (2015). *Does size matter for port coopetition strategy? Concept, motivation and implication*. 1–22. https://doi.org/10.1080/13675567.2015.1032229

Song, D.-W., & Parola, F. (2015). Strategising port logistics management and operations for value creation in global supply chains. *International Journal of Logistics Research and Applications*, *18*(3), 189–192. https://doi.org/10.1080/13675567.2015.1031094

Stake, R. E. (1995). *The art of case study research*.

Stamatović, K., Langen, P. D., & Groznik, A. (2018). Port cooperation in the North Adriatic ports. *Research in Transportation Business & Management*, *26*, 109–121. https://doi.org/10.1016/j.rtbm.2018.03.006

Stuart, T. E., & Sorenson, O. (2007). Strategic networks and entrepreneurial ventures. *Strategic Entrepreneurship Journal*, *1*(3-4), 211–227. https://doi.org/10.1002/sej.18

Talley, W. K. (2009). *Port Economics*. 1–229. https://doi.org/10.4324/9780203880067

Tang, J., Kacmar, K. M. M., & Busenitz, L. (2012). Entrepreneurial alertness in the pursuit of new opportunities. *Journal of Business Venturing*, *27*(1), 77–94. https://doi.org/10.1016/j.jbusvent.2010.07.001

Tang, J., Levasseur, L., Karami, M., & Busenitz, L. (2021). Being alert to new opportunities: It is a matter of time. *Journal of Business Venturing Insights*, *15*, e00232. https://doi.org/10.1016/j.jbvi.2021.e00232

Thomas, G. (2011). A Typology for the Case Study in Social Science Following a Review of Definition, Discourse, and Structure. *Qualitative Inquiry*, *17*(6), 511–521. https://doi.org/10.1177/1077800411409884

Tominc, P., & Rebernik, M. (2007). Growth Aspirations and Cultural Support for Entrepreneurship: A Comparison of Post-Socialist Countries. *Small Business Economics*, *28*(2–3), 239–255. https://doi.org/10.1007/s11187-006-9018-x

Trujillo, L., Campos, J., & Pérez, I. (2018). Competition vs. cooperation between neighbouring ports: A case study in Chile. *Research in Transportation Business & Management*, *26*, 100–108. https://doi.org/10.1016/j.rtbm.2018.03.005

Tull, M., & Reveley, J. (2008). Introduction: Port Reform in the Asia-Pacific Region. *Port Privatisation: The Asia-Pacific Experience*, 1–16.

Ucbasaran, D., Westhead, P., & Wright, M. (2007). Opportunity Identification and Pursuit: Does an Entrepreneur's Human Capital Matter? *Small Business Economics*, *30*(2), 153–173. https://doi.org/10.1007/s11187-006-9020-3

Uy, M. A., Chan, K.-Y., Sam, Y. L., Ho, M. R., & Chernyshenko, O. S. (2015). Proactivity, adaptability and boundaryless career attitudes: The mediating role of entrepreneurial alertness. *Journal of Vocational Behavior*, *86*, 115–123. https://doi.org/10.1016/j.jvb.2014.11.005

Valliere, D. (2013). Towards a schematic theory of entrepreneurial alertness. *Journal of Business Venturing*, *28*(3), 430–442. https://doi.org/10.1016/j.jbusvent.2011.08.004

Verhoeven, P. (2010). A review of port authority functions: towards a renaissance? *Maritime Policy & Management*, *37*(3), 247–270. https://doi.org/10.1080/03088831003700645

Vieira, G. B. B., Neto, F. J. K., & Amaral, F. G. (2014). Governance, Governance Models and Port Performance: A Systematic Review. *Transport Reviews*, *34*(5), 645–662. https://doi.org/10.1080/01441647.2014.946458

Wang, J. J., Ng, A. K.-Y., & Olivier, D. (2004). Port governance in China: a review of policies in an era of internationalizing port management practices. *Transport Policy*, *11*(3), 237–250. https://doi.org/10.1016/j.tranpol.2003.11.003

Wang, K., Ng, A. K. Y., Lam, J. S. L., & Fu, X. (2012). Cooperation or competition? Factors and conditions affecting regional port governance in South China. *Maritime Economics & Logistics*, *14*(3), 386–408. https://doi.org/10.1057/mel.2012.13

Wang, P., & Mileski, J. (2018). Strategic maritime management as a new emerging field in maritime studies. *Maritime Business Review*, *3*(3), 290–313. https://doi.org/10.1108/mabr-06-2018-0019

Westhead, P., Wright, M., Ucbasaran, D., & Martin, F. (2001). International market selection strategies of manufacturing and services firms. *Entrepreneurship & Regional Development*, *13*(1), 17–46. https://doi.org/10.1080/089856201750046793

Woo, S.-H., Pettit, S., Beresford, A., & Kwak, D.-W. (2012). Seaport Research: A Decadal Analysis of Trends and Themes Since the 1980s. *Transport Reviews*, *32*(3), 351–377. https://doi.org/10.1080/01441647.2012.660996

Wood, M. S., & Pearson, J. M. (2009). Taken on Faith? The Impact of Uncertainty, Knowledge Relatedness, and Richness of Information on Entrepreneurial Opportunity Exploitation. *Journal of Leadership & Organizational Studies*, *16*(2), 117–130. https://doi.org/10.1177/1548051809335358

Yin. (2003). *Case Study Research Design and Methods.* 3rd Edition, Sage, Thousand Oaks. https://www.scirp.org/(S(lz5mqp453edsnp55rrgjct55))/reference/ReferencesPapers.aspx?ReferenceID=1994558

Note :

- Ray, S., Cardozo, R., 1996. Sensitivity and creativity in entrepreneurial opportunity recognition: a framework forempirical investigation. Presented at the Sixth Global Entrepreneurship Research Conference, Imperial Col- lege, London.
- Patton, M. Q. (1990). Qualitative evaluation and research methods. SAGE Publications, inc.

GOING PAPERLESS AND ITS IMPACT ON GOVERNANCE: AN EXPLORATORY CASE STUDY OF THE DANISH PORT AUTHORITY AND ITS COMMUNITY.

1.ABSTRACT

OBJECTIVE

The result of current changes in the digital opportunities for Danish port authorities has been increased port boundaries. One development currently under consideration is the digitalisation and 'going paperless' approach of Nordic ports, whereby they would share information digitally and improve their port function performance. This development is still in its rudimentary stage, and there is currently no standard development of digitalisation in Danish ports. Some ports, like the Associated Danish Ports (ADP), the Port of Aalborg and the Port of Aarhus, are ahead of others in terms of investigating this phenomenon. Other small and medium-sized ports, however, lack the resources to investigate the 'test and trial' method of digitalisation. Moreover, they also lack the resources to invest in educating themselves about data and data owners. Specifically, what kind of data-oriented platforms can Danish port authorities collectively develop under the port law of Denmark, considering their legal roles and responsibilities. This raises two challenges of: 1) limited resources and funds to digitalise; and 2) legal roles and responsibilities hinder small-to-medium sized ports to digitally exchange their resources. These two challenges are not only reflected in the Danish ports authority community, but in all small-to-medium sized ports across Europe. This paper can therefore be used by any port authority community that consists of small-to-medium sized ports working under port law and providing basic infrastructure.

RESEARCH QUESTION

The purpose of this paper is to analyse and generalise digital information sharing so that other port authorities can use it as a blueprint. Regarding the scope, this paper will take the Danish port community as its unit of analysis. This community consists of port authorities, port users, and port service providers. To achieve this, this paper addresses the following questions: 1) How does the Danish port authority and its community define digital resource sharing? (2) How does the Danish port community define the port logistical process? (3) What are the challenges of sharing resources digitally beyond the role of the landlord port and its impact on the port's legal and jurisdictional system? These developments have opened up a dialogue about what happens to resource sharing when ports, which had previously been landlord ports and had enjoyed established relationships with their customers, desire change. There is the question as to how this affects other port authorities, but also the whole value chain – for example stevedores, agents, and ship captains. To analyse this question, we interviewed six Danish ports, six port service providers, and three port users between 2017 and 2018.

THEORY

The concept of resource sharing derives from resource dependence theory (RDT) (Barney, 1991; Grant, 1991; Srivastava et al., 1998; Wernerfelt, 1984). RDT is drawn on to investigate the logistical processes which illustrate dependency relationships, which can capture value in logistical processes. Here, the dependency relationship focuses on the sharing of 'information availability' and the transfer which takes place between stevedores, ship captains, agents, and port authorities to achieve optimal development in port function, as defined by (Brooks & Cullinane, 2006b) on port governance. This will highlight the scope and boundaries of information sharing between the port authority and its port users, as well as highlighting the concept of what information is shared and how this information captures value for the port community. It is argued that resource sharing can also be a solution to the problem which occurs when two port users undergo a contract based interaction or trust based interaction that would capture a certain value by pooling their resources. The concept of resource sharing has a time limit based on the value of its undertaking, and the port actors who allow the sharing of resources to achieve that value.

METHODOLOGY AND DATA COLLECTION

In this paper, the case study methodology of (Yin, 1994) and (Miles & Huberman, 1994) are used to illustrate the different types of resource dependencies based on the logistical process model. This provides an opportunity to illustrate the relevance of resource sharing with the port authorities by investigating processes within a real long-term context. In-depth structured interviews with C-level management (Chief Executive Officers, Chief Financial Officers, and Chief Commercial Officers) in the Ports of Esbjerg, North[6], Køge, Aarhus, Aalborg, the Association of Danish Ports, and the Port of Haminakotka, were undertaken. The research also included interviews with the main port stevedores and freight forwarders for cross-analysis, as well as various government associations officials such as the Danish Port Association, Swedish Port Association, Finnish Port Association, Danish Shipping Association, and the Nordic single window association. The data was coded using NVivo software, with three cycles of coding undertaken. The first set of coding was done to establish the logistical process model and to define the view of the port communities on digital resources. The second coding was done to recognise various possible forms of digital resource exchange. The third set of coding was done to understand the challenges and implication of sharing these digital resources.

RESULTS

Through the lens of resource sharing, this paper contributes a Logistical Process Model (LPM) that highlights the range of users and the way that information is connected. It also illustrates the relationship with the network, specifically contract and trust-based interaction. Trust based interaction adds a level of possibility in sharing resources in the digital ship plan platform which is overlooked by contract based interaction. However, there are various interactions that are required to share data resources between the port users. The process of interaction explains how, when considered from the network perspective, resource sharing is affected by high or low contribution of resource sharing. It also analyses whether it helps in capturing value using the neutral part of the Port

[6] The 'Port of North' is a pseudonym

Community System (PCS), a platform which provides highly embedded networks with the opportunity to 'share information'. This information has the potential to contribute to areas including: port call optimisation (berth allocation; crane booking and allocation; pilots and tugs booking requests); port maps (archival master data); cargo notification for shippers; and port authority services for stevedores and agents. This paper concludes that when interaction is based on contractual relationship, the optimisation of executing an operation is optimal due to transparency of its interaction. Upon analysis, it appears that whilst the legal and jurisdictional components of a port are not yet ready for port authority digitalisation, they are currently ready for port community digital resource sharing. In closing, this paper makes its recommendations concerning the introduction of a PCS.
Keywords: Port Authority, Entrepreneurship, Digitalisation, Value, Resource sharing

2. INTRODUCTION

For many years, port authorities have been the centre of coordination for operations and information sharing between agents, stevedores, and truck, rail, and vessel operators. Most of these resources are seen as essential for the survival of port authorities because they do not own these resources themselves but rather receive them from other port users. Sharing information digitally between agents, stevedores and vessel operators, and co-ordinating their activities with the port infrastructure has a number of benefits. This includes a decrease in bureaucratic procedures related to berth and crane booking, as well as a decrease in the manual invoicing confirmation procedure. This leads to a reduction in the administrative burden for both the port authority and port users. Since Danish port authorities consist mainly of small-to-medium-sized ports, this transition can be straightforwardly integrated into their networks.

Over the past decade, various Danish port authorities have initiated digital transition processes, attempting to go paperless in their day-to-day administration. This has piqued the interest of both practitioners and researchers. As digital technology evolves, more innovative ways of sharing information has appeared. For the Danish Port of Esbjerg, this started with a digital form on their website, while for the Port of Aalborg it has consisted of greater emphasis on blockchain. These development differentials between ports can be seen across Denmark, and may accelerate the dissolution of some of the smaller ports. Given this, a standardised neutral information sharing platform which adopts well-defined governance can help the Danish port community to share best practice. Given this situation, it begs the questions: 'Which digital resources can be shared by medium-sized port authorities?' and 'Which digital resources can be shared by a neutral information sharing platform?'

To answer these questions, we first need to define what is meant by, and what qualifies as, digital resources. In this paper, the term 'digital resources' rather that 'digital information' is used since both port authorities and the port community do not only share *static* information, but also capabilities of planning, scheduling, and insights. As such, the term 'digital information' would dilute the desired emphasis. Digital resources refer to the important co-ordination and communication of data between different port users when undertaking port activities. This paper delves in more depth into the phenomenon of digital resources in section (4.1).

In Section (4.1) this paper adopts the guidance emerging out of Resource Dependencies Theory (RDT) to explain digital resources in the port context. Once our understanding of digital resources has been delineated, this paper proceeds to provide a map of the logistical process that highlights the contribution of 'which digital resources can be shared by medium-sized port authorities?' and 'which digital resources can be shared by a neutral information sharing platform'? Summarising our analysis of Section (7), this paper elaborates on the different types of categories where medium-sized ports have deemed the sharing of digital resources to be essential. Section (7) explains: 1) How does the Danish port authority and its community define digital resource sharing? (2) How does the Danish port community define the port logistical process? (3) What are the challenges of sharing resources digitally beyond the role of the landlord port and its impact on the port's legal and jurisdictional system? In summary, section (7.3) describes how digital resources are initially analysed in this paper by mapping the logistical process exchanged by port users (e.g. vessel operators and truck operators) and port service providers (port authority, stevedores and agents) in the port logistical process. It argues that this flow of interaction and resource exchange is done either by contract based interaction or trust based interaction. This digital resource sharing interaction is then mapped onto the logical process model, highlighting which of these interactions are essential for the port authority. For example, with respect to the optimisation of vessel berth allocation, ETA is the most important digital resource for berth planning. However, this information is shared and updated by the vessel's selected representative (i.e. the agent) via email rather than by the vessel itself. This is not the most efficient way of sharing information, either for the agents or the port authorities. This highlights the importance of sharing this information in a dynamic way on a digital resource sharing platform. In Section (8), this paper provides the results concerning the boundaries of sharing digital resources and going paperless, mainly highlighting the argument as to who should be responsible for the governance of owning the process.

3. LITERATURE REVIEW

3.1 INTERORGANISATIONAL NETWORK

Most of the supply chain research views port logistical chains as linear, with port authorities presented as being the central point, having relationships with agents (the supplier), carriers (the customer) and other port authorities. However, like every other actor in the value chain, port authorities are part of a much complex network and system of dependencies. Most of the port authority research can be explained from the perspective of a single actor, or as the relationship between different actors' perspectives, without taking the dependencies of the whole logistical chain into consideration (Martino et al., 2010, 2013, 2015; Martino & Morvillo, 2008a). When studying dependencies in interorganisational networks, Hakansson and Johanson (1992) provide insights into the existence of shared activities, shared resources, and how relationships are developed in the logistical chain (Hakansson & Snehota,1995). Most of the interorganisational relationships are studied from either the transactional cost or resource shared perspective. The transactional cost perspective determines the container cost from a single actor perspective (Cho, 2014). The concept of resources and relationships, on the other hand, provides possibilities in terms of studying the intricacy of a network (Håkansson & Persson, 2004; Szeto, 2000). Managing both vertical and horizontal interorganisational relationships in the port logistical chain means that the chance of collaboration is higher, and there is less focus on rivalry and mistrust (Håkansson & Persson, 2004; Szeto, 2000). In the port community, resource dependencies are based on the activity and operations carried out by the agents, carriers, terminals, and stevedores. Ports tend to be dependent on the choices made by the cargo owner and carrier, especially when they decide to select a port to transport their goods (T Heaver et al., 2000, 2001; Trevor Heaver, 2006). Similarly, the port authorities are also dependent on the agents for the process of port selection (J. L. Tongzon, 2009)

This paper adopts the network perspective on resource dependency and resource sharing, with discussion focused on the type of dependencies which exist in the port community. We explore whether these dependencies can be optimised Through digital sharing. To highlight these dependencies, we also highlight the relationships between logistical activities and actors (Hakansson & Johanson, 1992). Our focus is on the properties of these resources and how different actors can access them. For example, the port community actor who is well-connected in the logistical system and has a good network may have resource access which other actors lack (Bichou & Gray, 2004; Marlow & Casaca, 2003; Paixão & Marlow, 2003). Because of this, this paper is inspired to further investigate the type of relationships which exist. In this regard, the relationship with the port community and logistical chain was investigated through: port community networks (Carbone & Martino, 2003); interorganisational relationships of control (Carbone & Martino, 2003; Martino et al., 2015; Martino & Morvillo, 2008b; J. L. Tongzon, 2009); and port authorities and customer satisfaction (Bichou & Gray, 2004; Brooks & Pallis, 2008; Carbone & Martino, 2003; Marlow & Casaca, 2003; Martino & Morvillo, 2008a; Paixão & Marlow, 2003)

Port authorities' dependencies arise either from a lack of legal jurisdiction to receive information or through the control of information by network actors. Port authorities have high dependencies on information accessibility which is owned and controlled by shippers, agents, carriers, and terminal operators. In some cases, even when there are legal requirements for receiving certain information from the interorganisational network, the port authority faces delays and errors in obtaining it. To counter this, the port authority tends to focus on investigating the needs of its customers. This is based either on the port selection of the carrier or cargo owner (Chang et al., 2008; T Heaver et al., 2000, 2001; Trevor Heaver, 2006; López & Poole, 1998; K. Y. A. Ng, 2006; Robinson, 2002; Song & Panayides, 2008; J. Tongzon & Heng, 2005; J. L. Tongzon, 2009; Yap & Lam, 2004) or it is based on value to satisfy customers (Bichou & Gray, 2004; Brooks & Pallis, 2008; Carbone & Martino, 2003) through which they can improve their strategies to increase trust with their customers. Port authorities can build trust within their communities to achieve the dependencies of providing berths to the carrier, even though they have a legal right to access this information. Port authorities can overcome network control on resources by creating alliances to gain accesses to information (Tushar K Das & Teng, 2000; Dyer & Singh, 1998; Eisenhardt & Schoonhoven, 1996). On the other land, port authorities manage their high dependencies by investing in technological development and digitalisation to make controlled information accessible. Port authorities are, however, restricted in their scope due to their governance structure. Thus, to manage dependencies, port authorities have to create a trust network, an alliances network, and contractual collaborations to make resources accessible to each other.

The paper approaches the possibility of resource sharing (Håkansson & Johanson, 1993) from both a trust-based interaction perspective (Nooteboom & Six, 2003) and a formal contract-based interaction perspective (T K Das & Teng, 1999). Although trust-based interaction has a high value in the supply chain, it is rarely studied in the literature. Similarly, contract or contractual research is studied from a resource-based perspective (Madhok et al., 2004) but is often overlooked by optimisation or resource sharing. This paper aims to examine the dependencies of the port authority from the port community perspective (e.g. agents, shippers, cargo owners, and carriers) with regards to digital resource sharing and exchange. It further aims to highlight these dependencies in the logistical process and to discuss the implication of a port's legal and jurisdictional boundaries in terms of making their digital resources accessible.

3.2. LEGAL AND JURISDICTIONAL LEGISLATION IN DANISH PORTS

In 1999, the erstwhile Commercial Port Law was abolished and replaced by a new law – the Danish Port Law. The rules and provisions of this law were decided by the Ministry of Transportation, who translated the international rules and present directives, and implemented EU regulations into this port law. To study port authority dependencies, it is imperative to learn about the port authority's legal and judicial role with respect to the logistical chain. In Chapter 4 Section 6, the Danish Port Law delineated that the port authority can have one of five governance structures: a state port, a municipal port, a municipal self-governing port, a wholly or partly municipally owned limited company, or a port organised under private law (Merkel & Sløk-Madsen, 2019a). The governance structure of the Danish port authorities affords a level of freedom for participating in digital resource sharing. State ports are managed by the Minister of Transport, and they can offer basic berth facilities and provide land for the construction of cranes and warehouses. Municipal ports have the same boundaries but are governed by the municipal authorities. Municipal self-governed ports are allowed to hire expert management to develop strategies and maintain port business, for example the Ports of Aarhus, Esbjerg, Frederikshavn, Kalundborg, ok Koge, Odense and Vejle. Under this type of ports governance, Danish ports can create new business if there is no private actor who can do so. A few Danish port authorities are wholly or partly municipally owned limited companies which act as commercial enterprises, meaning they can provide cranes and warehouses and can merge with other port authorities to carry out operations. These ports are the Association of Danish Ports, Copenhagen Malmo Port, the Port of Grenaa, and the Port of Odense. As of 2022, there are no private ports in Denmark.

Under the Statutory Order on Standard Regulations for the Observance of Good Order in Danish Commercial Ports, port authorities are responsible for providing berths to vessels when notified, within a 24-hour period (under section 1(2) of *Notification* and section 3(3) of *Berth*). Section 1 (2) states that port authorities require the ship data, expected time of arrival, expected time of stay, and the purpose of the ship call. The port authority is highly dependent on agents for this information; the process is regularly characterised by errors and miscommunication. Under section 1(1-6), port authorities are also legally allowed to request information about the ship's type of goods and their expected waste disposal request. This process of sharing information is done via emails and phone calls.

Danish port law does not state that municipal self-governed ports and the wholly / partly municipally owned limited companies are entitled to receive information which helps them in providing cranes as a service. Information about the expected time of crane usage, the draught needed for the vessel, and the cargo type (non-dangerous) are not considered under Section 1 (2) of notification. This increases the dependency of the port authority on the port community, and simultaneously increases the administrative burden on the port authority. This creates a dilemma in that the port authorities which are municipal self-governed ports and the wholly / partly municipally owned limited companies can try and increase their resource (i.e. information) sharing capabilities through digitalisation.

3.3. DIGITALISATION IN PORT AUTHORITIES

A port authority exists to support different businesses execute their operations, which will ultimately contribute to competitive industrial development in the vicinity and guarantee the further existence of the port (L. V. der Lugt et al., 2015; L. van der Lugt et al., 2013). Some port authorities are not passive, but rather try to accelerate and guide industrial development within their port vicinity. However, legal regulations can place constraints on doing this, meaning that they can only focus on their core services – an approach which in time may threaten the very existence of the port (Hollen et al., 2014). Most of these regulations define the role of the port authority and its governance based on attracting cargo traffic and maximising profit for the government.

In this paper, it is argued that Danish port authorities can be entrepreneurial in nature and are zealous in how they prepare for disruption by building inter-organisational relationships with port users. This are the resources required for port survival. Port authorities that are hybrid in nature have both public and private elements while retaining their organisational structure (Verhoeven, 2010). Therefore, due to the ambition of hybrid ports to be more innovative so that they can thrive, they can best respond to changes in industrial development by investing in reliable and accessible super infrastructure. In this study, the term 'port authority' includes both its public role and its management role. Under port law, Danish Port authorities can be municipally self-governed entities which provide infrastructure accessibility such as berths, cranes and warehouses, or else they are partially municipally owned limited companies that have the same functions as municipally self-governed entities but can also provide operation services to port users (Merkel & Sløk-Madsen, 2019b). Similarly, most of the definitions used in the port authority literature explain the port's role as providing operation-supportive infrastructure, which has the responsibility to provide a safe environment and administration procedures, per the European Maritime Single Window (EMSWe) regulations.

The current situation in the maritime world, however, has propelled small and medium-sized Nordic port authorities towards a position of entrepreneurial zealousness. Such port authorities are defined as hybrid port authorities, who want to invest in their physical as well as their digitalisation infrastructure . This paper argues that hybrid port authorities are not only pushing the boundaries in terms of physical resource exchange, but are also aspiring to a greater exchange of digital resources in their role as a port authority. The digital aspect of the hybrid port authority can be explained as a key aspect of investing in digital resource exchange, in addition to the public and private responsibilities of port authorities, with well-established governance. Digital resources are the information and capabilities that port authorities require from the port network in order to perform their port functions efficiently. It is known that port governance describes the port functions of infrastructure, operations and strategy from both the legal and regulation level in both private and public sectors (A. K. Y. Ng & Pallis, 2010; Verhoeven, 2010; Zhang et al., 2019), but that it does not describe digitalisation resources information and capabilities as port functions. This does not mean there are no regulations with respect to digitalisation in port governance for Danish ports. This topic has been a focus of the port management literature and business in recent years (Tijan et al., 2021; Wareham et al., 2005) Following in the same vein, the aim of this paper is to contribute to the two streams, first by explaining the Danish port authorities' dependency on digital resources to provide 'operation supporting infrastructure, responsibility to provide safe environment and administration procedure', and secondly to respond to the impact of this function on port governance.

4. THEORY

4.1. CONCEPT OF RESOURCE-SHARING THEORY

The concept of resource sharing is rooted in the theory of resource dependencies theory (Hillman et al., 2009; Pfeffer & Salancik, 2003; Salancik & Pfeffer, 1978). As a concept, resource dependency was introduced in the 1970s through a range of research, but the most commonly referred to theories are those of Pfeffer (1972), Pfeffer and Leblebici (1973), and Pfeffer and Salancik (1978) (Pfeffer & Leblebici, 1973; Salancik & Pfeffer, 1978). Resource dependency theory states that an organisation understands itself and evolves within its environment based on its needs, and that adopting this approach should provide them with a steady flow of resources to implement their business objectives (Celtekligil, 2020). Resource dependency theory approaches the need to reduce an organisation's dependencies by increasing the elements of resource sharing through joint ventures, vertical integration, political action, alliance and collaborations (Salancik & Pfeffer, 1978). The need to survive makes it imperative that port authorities realise ways to share their interdependencies. Many researchers have studied port authority dependencies (Carbone & Martino, 2003; Martino et al., 2013; Martino & Morvillo, 2008b) but its connection to resource sharing has not been well exploited.

Considering the importance of resource sharing within the port community, De Martino et al. (2013) introduced an expanded perspective of independencies between port operators and innovative business opportunities (Martino et al., 2013). Baird (2000) presents a list of port functions undertaken by port authorities which should be executed to an optimal level in order to be competitive in the market and to bring more cargo traffic to port users(Baird, 2000). Danish port authorities have achieved this through strategies and alliances in their intra-organisational network in order to create dense contract-based interactions, which makes their port performance more efficient. Port authority strategies can be summarised as follows: promoting business alliances with other actors in the supply chain (Langen & Nijdam, 2009; L. V. der Lugt et al., 2015)); increasing embeddedness at the national level of port networks (Parola et al., 2017; Soppé et al., 2009); and encouraging the port authority's involvement in going beyond the jurisdiction of the ports and placing interest in hinterland strategies (Berg & Langen, 2011; Horst & Langen, 2008). These strategies and alliances in the intra-organisational network contributed to the port dependencies, and improved the performance of port activities and the efficiency of services. In achieving this, Danish port authorities have their own specific resources which they can rely on as well as specific digital resources from other port actors which they may have a high or low dependency on. This paper has focused on examining the context of resource exchange in order to optimise the sharing of these dependencies based on trust or control. Previous research on sharing resources has been undertaken in areas including: collaborative knowledge creation (Ding & Huang, 2010); sharing operational information items to reduce the total inventory in supply chains (Kumar & Pugazhendhi, 2012); more country-specific resource exchanges in container terminals (Yi et al., 2000). This paper, however, introduces the concept of trust-based resource sharing and contractual-based resource sharing.

Digital resources are composed of many different types of information, including data, insights and digital capability which can be shared or exchanged digitally. The research tends to use the words 'exchange' and 'sharing' interchangeably, but in this paper 'exchange' is used to highlight the fact that our enquiry stems from the literature of port governance and inter-organisational network interaction (trust-based and contractual-based interaction), both of which strands have a legal or regulatory foundation embedded in their structures. Therefore, as a keyword, 'exchange' emphasises the fact that it will continue on a long-term basis, whereas 'sharing' is understood more as an occurrence which is implemented on a non-regular basis. This paper focuses only on digital types of resource dependency.

A brief overview of resource dependency theory and its application in port authority digital functions is undertaken in order to examine the potential for digital resource sharing. Resource dependency theory has guided much inter-organisational research in determining the resource-based relationship developed over time within a network (see Barney, 1991; Tushar K Das & Teng, 2000; Eisenhardt, 1989; Grant, 1991; Wernerfelt, 1984)

The exchange of dependent digital resources is based on three related factors: (1) the resources need to be critical for the survival of the port authority, and must contribute to the port function described (Baird, 2000); (2) the resources are used to build both contractual and trust relationships with the port users and cannot be substituted (Brooks & Cullinane, 2006b; Brooks & Pallis, 2008); (3) the resources are already allocated to port authorities but are ambiguous with regards to utilisation in various port functions. The process of resource sharing in the logistical process model is examined, investigating which resources – when shared – create value creation for small and medium-sized Danish ports. To achieve this objective, the logistical process model (which encompasses different phase of activities, resources, and actors to understand the layers of interaction) is used. It is argued that digital resource sharing brings competitiveness to both resource utilisation, and also makes performance more competitive and efficient.

5.RESEARCH QUESTION

This study argues that port authorities and port actors have internal resource dependencies, both physical and digital. To a significant extent, port users have the discretion to determine resource sharing in social embedded networks while port authorities are guided by structured legislation and regulations as well as specific port regulations. This paper investigated how Danish port authorities can go paperless in resource sharing? Rather than examining the *physical* functions of the port community, this research aims to answer the following questions: (1) How does the Danish port authority and its community define digital resource sharing? (2) How does the Danish port community define the port logistical process? (3) What are the challenges of sharing resources digitally beyond the role of the landlord port and its impact on the port's legal and jurisdictional system?

The result section is Divided into two. First, it highlights the digital resources in the Danish port interorganisational network and their dependencies using a Logistical Process Model (LPM) diagram, specifically looking at digital resources sharing in executing physical port functions. Second, it presents the impact of these developments in terms of current Danish port governance. It is argued that if port users exchange digital resources with Danish port authorities, this might also increase the likelihood of investing in more automated or autonomous intelligence, which would result in Danish port authorities focusing more on digitalisation. The research objective of this study is, using the LPM, to illustrate the digital resources that port authorities are dependent on in order to perform their port functions, and how the current legal and jurisdictional status creates challenges in terms of exchanging these digital resources.

6.METHODOLOGY

6.1.INTRODUCTION

Following (Yin, 1994) and (Miles & Huberman, 1994), the case study methodology outlined in this paper explores the different layers of resource dependencies and how they are relevant for resource exchange with port authorities in terms of their performance. Several reasons are advanced below in order to justify this empirical setting.

- Firstly, employing (Stake, 1995), xi) explanation that a case study is "the study of the particularity and complexity of a single case, coming to understand its activity within important circumstances", this research methodology helps us trace the complex relationships of port actors, and how their interactions affect their activities. As such, this method makes it possible for us to research "how" (Marschan-Piekkari & Welch, 2004). This follows Yin's view that "how and why questions are more explanatory and likely to lead to usage of case studies" (2009: 18). The research question follows the exploratory study in answering 'how' questions when the topic of dependencies of resources in the literature has yet to be fully explored.
- Secondly, longitudinal data can be explored using case study methodology (Easton, 1998). This is favourable for this study as data has been collected over a three-year period. This is crucial for this piece of research because resource dependencies in a social embedded network change over time. In this study, the aim is to illustrate the different layers of resource dependencies based on the port actor's relationship with the port authority. This provides the opportunity to illustrate the relevance for resource sharing with the port authorities by investigating processes within a real long-term context.

- Thirdly, with respect of analysing cases connected to port authorities and port governance, most of this research is guided by case study methodology because it provides relevant insights. Using Yin's definition that "a case study is an empirical enquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between the phenomenon and context are not clearly evident; and in which multiple sources of evidence are used" (2009, 23), this paper agrees that port authorities are embedded in a dynamic and complex network. This means that port users and port service providers perform different functions, which need to be illustrated in specific detail (Brooks & Cullinane, 2006b) This raises the questions as to whether port actors change their activities based on their relationship, and how far do changes develop with regards to the transfer or sharing of digital resources.

6.2.CASE SELECTION

This question is answered by selecting a case that reflects the digital resource phenomenon. The case was selected using the criteria developed by (Miles & Huberman, 1994), namely: (1) the prospect of implementing the LPM, where in this case we map the level of digital resource dependencies and level of resource sharing to each logistical processes; (2) the existence of the phenomenon in the case; (3) the prospect of researching analytical generalisation; (4) the prospect of reliability justifying the real-life phenomenon; (5) flexibility of undertaking research using confidential information.

To comply with criteria 1-4, it was vital to select port authorities, port users and service providers which represented the structure, size and association involvement of different organisations, that they did not contain the same board directors, and that they had differing levels of technological innovation. Adopting these different characteristics enabled an analysis of the various functions of the port authorities, including triangulation and conducting analytical generalisation. In addition, to comply with criterion 4 (the prospect of reliability justifying the real-life phenomenon) and to follow the proposed research paradigm of using a positivist case study, the selected case enabled a long-term analysis since it could be followed throughout the process. In addressing this, we first present our process of data collection in section (6.3). Second, we explain our data analysis and coding cycle in section (6.4.1). Third, we present the process of triangulation of the data collected and coded (6.5).

6.3.DATA COLLECTION

The data collection process, which took place between February 2017 and March 2019, was iterative. It involved conducting interviews, studying documents and undertaking observations, thereby ensuring triangulation (Thomas, 2011; Yin, 2009) The interviews conducted with C-level management (e.g. CEOs, CFOs, CCOs) were the main source of information, with document analysis and observations used to support and add further information to the interview in terms of specific port functions where digital resources were exchanged by port actors. This was a mechanism by which the information collected through the interview does have an actual source present in their physical business.

This paper follows Thomas, 2011 in that the analysis of the selected port actors provides a rich illustration of their interdependencies. It also provides analytical insights into the perspectives of the

C-level management in terms of the digital resource dependencies and the potential for exchange with port authorities. There remains the possibility that selected port actors are unable to provide valid arguments for the research. Prima facie, it should be emphasised that since the research paradigm used is positivist, and using the criteria of case selection, the selected case studies ought to follow a literal replicated logic (where cases present similar outcomes) or a theoretical replication logic (where cases present different outcomes) (Rowley, 2002; Yin, 2003). It is also important to achieve theoretical saturation in our inquiry (Eisenhardt, 1989). Furthermore, this paper will also pursue what Yin (2009: 21) described as "generalisation at the theoretical propositional level and not to population or universe."

Port Actor	Data Source	C- Level experts
Port Authority	Port of Esbjerg	Chief Executive Officer
		Chief Commercial Officer
		CFO
		Port Control
	Port of Aalborg	Director
	Port of ADP	CEO
		CFO
		CCO
	Port of Køge	CEO
	Port of North	CEO
	Port of Aarhus	CCO
	Port of Haminakotka	CEO
		CFO
		CCO
Public	Danish Port Association	Director
	Finnish Port Association	CEO
	Danish Freight Forwarding Association	Head of Politics
	Danish Ship Broker Association	Chairman
		CEO
	Danish Shipping Association	Director
	Danish Safe Sea Net	CEO/Assistant
Private	Shipping DK	CCO

Table 10:Data Source

6.3.1. Questionaries and Interview Method

A literature review using a theoretical analysis of the port authority literature, port governance and resource dependency theory was used to format the questions in the interviews. Emphasis was given to the context of the digitalisation collaborative project and work in progress ideas. During the interviews, it was assumed that the essential relationship with customers would highlight the dependency of the Danish Port Authority. In some cases, good examples of the challenges faced by the Danish Port Authority with respect to digital resources were also given. The questions were purposefully abstruse with respect to customer relationships so that the interviewee could not make the narrative positive. One interviewee was asked to describe their important digital resources, the source of these digital resources, and the steps required for implementing them. Interviewees were open to sharing comprehensive knowledge about the relationships which they considered important for each port function. For example, this included the form of communication generated, their customer survey satisfaction reports, and their future ambitions for their digital projects.

The Interview method was planned such that as much rich and detailed information could be gathered from experts, thereby creating a rich base of qualitative data. This approach was informed by the explorative nature of this study, as well as the possibility that the study could be conducted longitudinally. Some interviews provided more insights related to the ports network and their relationship with each other. In total 22 interviews were conducted, with the majority done onsite, with three conducted online via Skype[7]. In answering the question of "whom" to interview next, Babbie's (2012) snowball sampling technique was used by asking the interviewee to either (1) in the case of the port authority to suggest a colleague who had expert knowledge in our specific area of interest, or (2) in the case of a port service provider or user, to suggest a company who they maintained an important relationship with.

6.4.DATA ANALYSIS: LOGISTICAL PROCESS MODEL

The data were analysed using Miles and Huberman's (1994) reduction, display and verification processes. At first, the transcripts were prepared for coding using a template based on Kings' (2012) template analysis. The code was created based on the resource based dependencies, port authority and port governance literature, as noted above. In total, 21 interview transcripts, field notes and observations, and documentation were analysed. The coding process was undertaken using NVivo. Our pathway to analysis was again guided by Kings (2012), following the steps of reading and reflecting the transcript, coding the data, and then reflecting on it and refining accordingly.

The coding of the transcribed interviews is divided into three different coding cycles. The intention is as follows: 1) the process model is defined by the port authority and the port community, 2) the process model is then grouped into services which can exchange resources digitally to provide information within their services; 3) the services are later recognised as having provided input into discussions about the constraints of the legal system for the port authority. Figure (12) illustrates the data analysis required to map the process model.

[7] Skype is a voice or video call service.

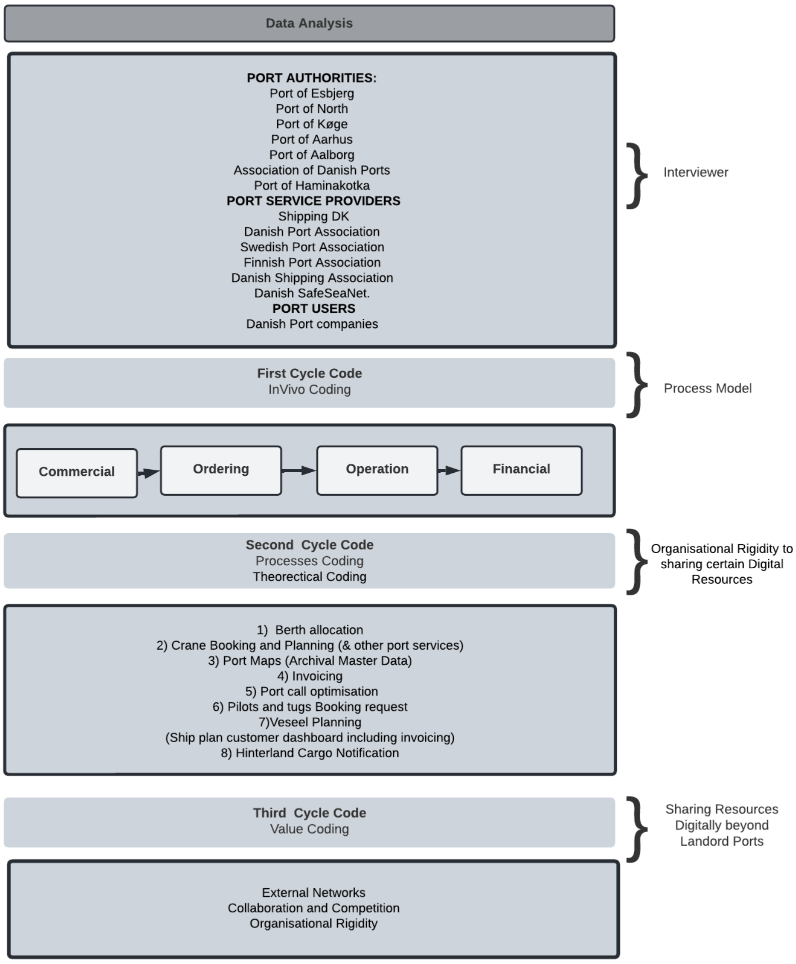


Figure 12:Data Analysis With Logistical Process Model

FIRST CYCLE CODE: Process Model

Firstly, the coding was undertaken using NVivo, in which keywords used by the interviewees for specific questions on explaining port functions, relationships and resources were highlighted. This meant that these functions could be isolated and then translated into the business process where digital resources are shared, and can support the trust based interaction or relationship or contract based interaction and relationship.

SECOND CYCLE CODE: Rigidity in sharing digital resources

Secondly, processes coding was used to map a repetitive form of action, namely the interaction between the port authority and the port user, in order to accomplish a particular port activity. Furthermore, the coding was done to map resource dependencies and organisational rigidity to sharing certain digital resources. The theoretical code was used to identify the most valued problem in the port authority processes, which can provide reliability, fit and usability.

THIRD CYCLE CODE: Sharing resources digitally beyond landlord ports

Thirdly, value coding was used to highlight the relationship aspect of resource sharing, and to emphasise the challenges of collaboration and where competition occurred. Trust based interaction is a crucial keyword for resource sharing, especially if the resource is essential for the survival of the port authority. As such, value coding is used to acknowledge trust based interaction between different port actors. Fourthly, in the second coding cycle, theoretical coding was used to map the key resources that connect to the 'creating' category of port function, thereby connecting it to the established governance literature. The value coding, with NVivo analysis and process coding, contributes to the next step of reflection and refinement, so as to help us answer the research question.

6.4.1. Coding process

Figure (12) explains the data analysis method and the procedure used to capture and summarise what the data mean. In the following section, the choice of key nodes from the literature is explained, in particular how this relates to both process coding and theoretical coding. In this analysis, port governance and port authority were given nodes that were initially used to highlight the port function which required digital resources. This narrowed the focus to the specific port function that creates value to customers but still exists within the parameters of the services provided by port authorities. Per (Brooks & Cullinane, 2006a), this paper limits itself to the port services that port authorities are legally responsible for in order to perform efficiently. Value coding is then used to illustrate important port activities of hybrid port authorities, which provide both physical and digital services to port users and service providers. The functions of each port are broken down into sub digital activities, which together create a port function.

For example, port call procedure is a port activity that is part of the service for vessels or terminals (Brooks & Cullinane, 2006b; Zhang et al., 2018). This includes a vessel berth allocation process, cargo loading and unloading operation planning, waste disposal schedule, slap oil pickup booking, crew change permission procedure, and provision for vessel crew and equipment maintenance. Following this, process coding is used to help illustrate sub digital port services and the sharing of digital resources between port users and port service providers. This provides useful insights about the interactions between different port actors and helps us narrow down what are considered the most important digital resources, and why they are shared with port authorities. This coding is also used to highlight the dependencies of various digital resources on port activities. Port call, for example, consists of the berth allocation processes, where digital resources provide a port call optimisation platform that shows the live booking and allotting status of the vessel by port control. To achieve this, the port authority is dependent on digital resources such as a live ETA update from the agent or stevedore. The second cycle theoretical code was used to identify the most valued problem in the port authority processes which can provide reliability, fit and usability for agents and stevedores. Theoretical coding highlighted the impact of present governance on the potential possibility of exchanging digital resources. This is further reflected in the contribution and conclusion section.

6.5. DATA TRIANGULATION

To achieve data triangulation and to obtain more comprehensive insights, for each type of port actor we interviewed more than one interviewee. With respect to port authorities, the goal is to illustrate the digital resources that port authorities are dependent on so they can perform their port functions, and how port governance status creates challenges in exchanging these resources. For this reason, C-level management were interviewed so that we could gain a comprehensive perspective concerning the port functions of berth request, crane booking, waste pickup, renting inquiry, water and electricity, and invoice tracking in their organisation. Unfortunately, it was not possible to interview all top-level respondents from the Port of Aarhus and the Port of Aalborg since the questions were diverted to sources who had more detailed knowledge on the topic. In the case of the other remaining port authorities, the Ports of Esbjerg, North and Køge, it was possible to interview all C-level Management and mid-level employees within the companies' networks. In the case of the Associations, in-depth interviews were carried out with the director /CEO of the Danish Port Association, the Danish Shipbrokers Association, the Danish Port Companies Association and the Danish Freight Association, as well as with DHL, Shipping DK and two transport companies. Two of the interviewees were also board directors of the Danish Port Companies Association. For triangulation purposes, C-Level management from the Finnish Port of Haminakotka and the Finnish Port Association were also interviewed.

7. FINDINGS

The section below presents findings which can help us address our research objective, namely to illustrate the digital resources that port authorities are dependent on in order to perform their port functions, and how the present status of port governance creates challenges in exchanging these resources. The following summarises the three sections that have contributed to this research:

1) The first sections are illustrated with interview snippets, which emphasise the current development of Danish interorganisational networks with respect to digital resources sharing. Following this, the characteristics as to how the port authority digital resources sharing philosophy should develop in order to encourage participation from the interorganisational network are examined;
2) The second section investigates different port functions where high dependencies of digital resources form their interorganisational network. The focus is on the specific function that requires digital resources, which has the managerial capability to provide performance efficiently and competitiveness;
3) The third section highlights the gaps and challenges of present port governance and its contribution in developing relationship structures.

In each section, the findings of the analysis are illustrated with verbatim quotations from the interviews conducted to provide authenticity and accuracy of the findings (Miles & Huberman, 1994) as well as to postulate a comprehensive presentation (Nicholson et al., 2013).

7.1. HOW DOES THE DANISH PORT AUTHORITY COMMUNITY DEFINE DIGITAL RESOURCE SHARING?

The sections above have presented a range of ways in which Danish digital resources are exchanged with their interorganisational network of port users and port service providers. The potential characteristics as to which port authorities can build or improve their digital resources, thereby changing their interorganisational network, are highlighted.

Within the Danish maritime system, there are several perspectives held by the interorganisational network regarding digital resource exchange. As defined by (Granovetter, 1985) all firms are embedded in a network where they collaborate with one another to create value for their customers and to provide various services to the market. Danish port authorities have the same philosophy, but due to their size they are not sufficiently self-sustaining to survive, meaning that any sharing of resources is a requirement rather than a choice. Most Danish ports are landlord ports, either municipally self-governed or municipally-owned limited companies (Merkel & Sløk-Madsen, 2019a). Digital resources such as information on master data, event data, historical data sets, insights and analysis are not generally viewed as being under the regulatory or legal aspect of port functions. Although it is argued that these kinds of digital resources are the foundation of efficient performance of any port function, they have not yet been considered by Danish port authorities. This is because of their ownership type and also the lack of clarity as to where the digitalisation processes of digital resource sharing should begin.

The terms 'exchange' or 'sharing' suggest that there should be two-way flow and clear governance that monitors the transparency of the flow of digital resources. The essence of this type of resource exchange is that it is created with formal agreements and that it builds on long-term relationships of trust based interaction between port authorities and Danish interorganisational networks of port users and port service providers in regulating the ongoing exchange of resources. Current examples of digital resources which have been exchanged are taken on a case-by-case basis to optimise a particular assignment or job. Most of these examples store their digital information in paper form or in a system lock ERP system. Currently, Danish port authorities use NAVISION for their accounting reporting purposes. This ERP is a customised version suited for smaller / medium-sized ports which is used by some Danish port authorities to register their port call manually by port control and the finance department, as described below.

> "…. use Navision for our daily recoding's of the port call and its was implemented in 2000 that why we named it Havn 2000. It's customised with ship list where we can register the port call and have a ship ledger, land leases, agent number and customer number (that doesn't change) and crane number for booking and we all manually input this information…."
>
> *CFO, Port of Esbjerg Interviewed, 2019, responsible for financial management and accounting under the regulations of a municipally self-governed port.*

Similarly, SafeSeaNet only provide a platform for the digital exchange of resources with regards to arrival notification (i.e. arrival notification, waste declaration and ship and commodity declaration) under the European single window directive (2009/16/EC):

> "SafeSeaNet is provided by European single window to standardise data sharing and to provide safe vessel journey. Port authorities don't provide or fill any information in platform. The only thing they can provide is waste declaration which the agent can submitted too…what would be beneficial if we have something similar for port as well…because they don't fill in ATA of the vessel in the single window."
>
> *CEO, SafeSeaNet Denmark, 2019*

Nevertheless, in Denmark both ERP (Navision) system and SafeSeaNet have limited scope in providing a platform to exchange digital resources. For instance, the ERP solution used by most of the Danish port authorities are not supply chain optimising or data transparency tools, but rather a financial management tool that is accessible only to the employees of the port authorities, and locked within its own IT infrastructure. These constraints have also been mentioned by the interorganisational network. Some port user representatives reflected that there should be a port community system that should be provided by the port authority to exchange data by the vessel's representative agents. Using this platform, ports can provide 'one place one platform', where port proactivity means that all the digital information is received from websites though an API, and the important event or real time update of ETA, operation planning and crane booking is done by the agent.

> "…. this system is developed to copy data from the agents' websites into the port platform, similarly, imported the data from safety net, the vessels name, when it supposed to arrive, etc. And then the agent will fill in some of the rest of it about cargo, cargo operations, what is going to happen to the vessel and booking the carne from the port…"
>
> *Director of the Danish Shipbrokers Association, 2018*

Similar suggestions were given by port actors with regards to Danish port authority infrastructure accessibility. For instance, cranes are pieces of superstructure owned by Danish port authorities such as the Port of Esbjerg, the Port of Aalborg, and the Port of ADP. Booking these cranes can often be challenging due to high demand, and the fact that crane sharing is planned manually. Simple misinformation such as wrong project cargo dimensions can delay crane accessibility and stall the entire operation. This issue can be solved by providing a crane booking and planning platform where you can exchange information in a dynamic manner and reuse historical master data which is filled automatically when the stevedores book for a specific cargo or vessel. As such, this decreases the administrative burden but also provides customer value for long-term port users:

> "…for digitalisation, I guess I would start between ports and agents because in terms of the stevedoring, the whole custom clearance, that is, from my point of view, internal within

STK (their company) ... That can basically control that, can drive ourselves. It's towards the external partners or shareholders here. But for cranes we need to talk to ports. I guess that the interaction between the local port and the forwarding agent would be a good place to do the kick-off basically.

Chief Commercial Officer, Shipping DK 2018.

"It's quite hard for port to digitalise all the transportation because most of them goes beyond their scope. So, it's a good idea to have one place to upload all document but ports shouldn't go beyond their infrastructure. That's unfair competition"

Politik- og kommunikationschef, Danske Speditører, 2018

In addition to the port users and port service providers discussed above, hybrid port authorities are zealous in integrating entrepreneurial change within their infrastructure, and lean towards digital resource sharing. Most of the port functions carried out by hybrid port authorities utilise email and phone communication to update or change important digital information. The Port of Esbjerg, the Associated Danish Ports and the Port of Aalborg have all taken steps towards recognising the importance of digital resources and the various sources (port users and port actors) with whom they can exchange information. In this research, the Port of Esbjerg is recognised as a hybrid port authority due to its strategy of digitalising its business processes, and its proactiveness towards market learning. They began their first phase of exchanging digital resources by turning paper-based arrival procedures into digital forms that the agents can complete on behalf of the vessel, or which the vessel can prepare beforehand by prefilling the information for the agents to confirm and submit. This means that they are not only a port authority aiming to improve physical operations, but they are also taking the initiative to digitally improve the operation. This is evidenced by the quotation below:

"I think where we are going into now, that's like the rest of all the rest of companies in Denmark I think, is that we are going for digitalising everything. Right now, we have a lot of projects for that, in fact … All the ships have a broker here in Esbjerg that have to report when they are arriving to Esbjerg and take care of all the paperwork (port call procedures). They don't have to wait until they arrive at the port. They can fill it out online because all the ships today. have the internet connection over the satellites, so they can do a lot of work themselves."

CFO, Port of Esbjerg, 2017

The majority of the Port of Esbjerg's digital resource exchange projects are focused on making a *part* of the business processes digital resources exchangeable, rather than optimising *all* the business processes from the customer journey perspective. These processes consist of: port controls' port call optimisation (the share of correctly-handled ship services (arrivals/departures/in port); intra-port operation (cargo lifts per hour (per crane); use of manpower (hours) per handled tonnes/numbers of cargo; damage costs per TEU; number of damages per operation or per day/month (new cars, containers, rolling stock); number of work interruptions caused by equipment) and terminal hinterland connectivity (number of work interruptions caused by equipment; number of modality shifts handled per day without interruption). It is suggested that, when exchanged, the digital resources should have the "characteristics of automated intelligence to improve business of the whole logistical process" by including pre-programmed rules (e.g. algorithms) based on historical data, which would provide comprehensive solutions to the requests of all port users.

Similarly, another hybrid port authority is the Port of ADP, which in 2018 transitioned their whole organisation so that it was more entrepreneurially zealous, thereby preparing the port for the new age of digitalisation. They hired a new Chief Commercial Officer, and in their first phase they focused on digitalising their internal business processes by going paperless in responding to customer enquiries, in registering their work hours and in atomising their internal invoicing confirmation procedures. The quotation below gives a sense of this:

> "[The] first priority is to build up a CRM system for the CCO. Then second is to get the archives digitised, scanned and put into the computer, so to speak. And a part of that we are waiting on the authorisation of the manpower at the port, so that the crane register, when the man is operating the crane, when he is sitting in the chair doing nothing, and all that kind and goes directly into the ERP system. Because today it goes with the paper note saying that …I have been doing six hours in 11 cranes. I've been driving containers and then there was a controller downstairs and then there was a controller over there and a controller over there, and then it's an economic department."
>
> *Chief Commercial Officer, Associated Danish Port, 2018*

Given that ADP is a fully municipally-owned limited company, it has a clear advantage over the other hybrid port authorities, which are business enterprises. This type of ownership allows them to exchange digital resources beyond the infrastructure of the port authority, for example in accessing the hinterland and inland port (i.e. quayside accessibility for SMPT trucks to navigate mega cargo towards landside inland depots, inland ports or hinterland warehouses). This advantage increases distrust and creates unfair competition with their own agents since, in certain cases, they are direct competitors. Consequently, this creates a hurdle for ADP when trying to convince the same agents to exchange digital resources. This highlights the question of how trust based interaction can be increased between port service providers and port users.

One potential answer to this question is that when digital resources are exchanged, they should have "characteristics of guiding principles" on data transparency in terms of who owns these digital resources, and what control people have in terms of access to them. The Port of Aalborg is one of Denmark's oldest hybrid port authorities, and works closely with research institutions in its attempt to strategically evolve into an intelligent port that focuses on business in addition to being an integrator. Interestingly, they interpreted digital resource exchange as a blockchain project, which has the essence of a hybrid port authority but is unfortunately beyond the scope of this study. In comparison, the Port of Haminakotka has set a good example for its fellow hybrid port authorities by creating a dedicated IT company and including digital resource exchange as part of their strategy. For them, digital resources exchange should be created by algorithm, and should contribute to analytical insights:

> "Digitalisation is where everything in the port will turn digital, all your documents will be online, which already is in Finland but also all the data you get from your port, from the customers and from ship… It is more or less that our company is doing for us that IT company also to our port because it is the port of Haminakotka owns only a part of that company."
>
> *CFO, Port of Haminakotka, 2018*

Their objective is to create a "one-stop service window" through small steps (Port of Haminakotka, 2021). The digital resource consists of open data which helps the Finnish transport agency. In the future, their aim is that vessels would be able to see their quay location directly – as well as the quay occupancy status – live online. The philosophy that digital resource exchange should have the "characteristics of one place, one platform" is solid. The "one place one platform" philosophy structures the digital resource exchange in one place, as one single truth, and as a single place where insights into the logistics process can be exchanged. For instance, for the port call optimisation process, a customer berth allocation dashboard on the platform would provide insights for the port authority, agents, and stevedores, all of whom are in the first tier in terms of exchanging digital resources in their interorganisational network of port users and port service providers.

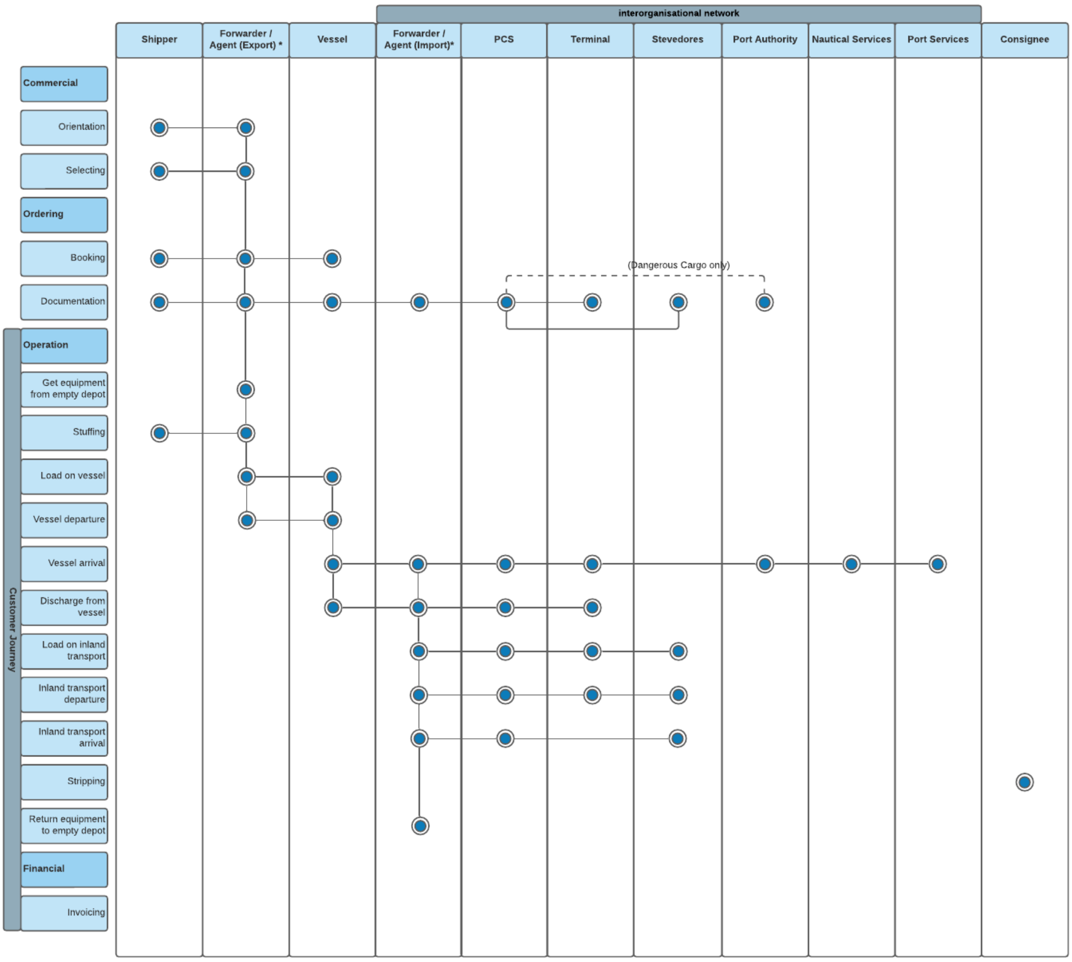
This paper argues that digital resources have a considerable competitive advantage for port service providers; simultaneously, Danish port authorities have a high dependency on digital resources. It is imperative that resource sharing exchange is built on trust-based interaction, customer value, and formal contract agreement. Regarding trust, when exchanging digital resources, both port users and port service providers should have total control as to who gets access to the whole platform. Regarding the contract agreement, it is necessary that the exchange should be based on contracts which state the intention of how the digital resources should be used, the number of years they will be stored for, and if they are to be used for insights, with whom they will be shared. Finally, regarding customer value, the Danish ports should aim for one single truth (one place, one platform) for the whole logistics process model.

7.2. LOGISTICAL PROCESS MODEL

As illustrated in the logistical process model (Figure 13), the journey of the vessel starts well before its departure in terms of the selection of the right market parties, documentation preparation, preparation of insurance, customs clearance, and planning intra-port operations. At first, to understand this, a diagram is required to highlight the relationships between different port actors for each step of the logistical process. Secondly, the different port functions that that have high dependencies on digital resources in forming their interorganisational networks are examined. The focus is on the *specific* functions which require digital resources, which narrowed the focus to specific port functions that create value to customers, but which still exist within the parameters of services provided by port authorities. Going beyond the boundaries of Brooks and Cullinane (2006b), this logistical process model (LPM) is not limited to port services that are under port regulation, but rather focuses on the overall logistics actors in the supply chain who have the managerial capability to efficiently provide performance.

Resource dependency in the port authority interorganisational network is very dynamic in nature. This is because most of the time the cargo owners (the exporter / importer) select a representative agent for a consignment based on their commission, which is also similar with regards to stevedores. The only monopoly that exists in Denmark is DanPilot. Most of the Danish port authorities interviewed for this study handle project cargo, bulk cargo and liquid cargo. Only the Port of Aarhus handles volumes of containers in addition to bulk and liquid. Therefore, the LPM is designed to encompass different type of cargo (e.g. break bulk, project cargo, container, and liquid). The LPM is divided into three areas, namely commercial, ordering, operation and financial. The successful conclusion of each step depends on multiple actors, both port users and port service providers. Each actors exchanges a set of resources such as information, infrastructure, or both. The objective of the LPM is to illustrates these resources changes as well as the relationship between the different actors. The Logistical process model is analysed in the following two parts:

1) How does the Danish port community define the port logistical process?
2) How can the port community exchange digital resources using the logistical process model?



This diagram focusses only on: **container transport, merchant haulage, FCL, import into W-Europe via Danmark , requiring additional inland transport to hinterland!**
Inland transport into W.Europe, return to empty depot, and movements at the export side (UK/ASIA) are represented simplified.
All is seen from the Danish interorganisational network. – so PCS, Terminal, PortAuthority, Nautical Services and Port Services are Danmark - based.
*: For the Forwarder/Agent 2 identities are introduced: one representing the Export side (i.e.Asia); one representing the Import side in Danmark .

Figure 13: Generic Logistical Process Model

7.3.HOW DOES THE DANISH PORT COMMUNITY DEFINE THE PORT LOGISTICAL PROCESS MODEL?

Commercial steps consist of “orientation” and “selecting” where shippers (the exporter / importer) select a forwarding agent to represent their consignment and prepare the relevant documentation. Per port regulations, Danish port authorities are not involved in this step, but are highly dependent on agents to attract greater volume to their ports. For this, the port authorities have implemented “dialogues” and “customer satisfaction surveys” to gain insight into how the port can be more attractive for both agents and shippers.

> “Does the Port of Aarhus, the services that we provide, do that create value for your company? Does the port of Aarhus understand your business? Are we cooperating with you for a satisfactory solution? Are we creating value for your company? The cluster, you could say, all the different kind of businesses that is within, if you call it a cluster, is that creating

value for you? Is the Port of Aarhus actively participating in developing your company or your business?"

CCO, Port of Aarhus, 2018

Most of the time, agents build long-term relationships with their clients, and they are well-versed with their demands and the procedures needed to transport cargo. Generally speaking, once they receive the assignment, they start the 'booking' procedure by contacting the vessel to transport the cargo. The 'documentation' is then prepared for customs clearance and the pre-arrival procedure at the port of call for the port authority is enacted. The import agent is contacted, who will hire a stevedore to unload the cargo. This part of the LPM emphasises the importance of the digital resources held by the agents. From the perspective of the port authority, they are the most important port user; the port authority is highly dependent on their digital resources exchange. The quotation below from an interview highlights the 'booking' and 'documentation' procedures.

"It depends a little bit. For instance, if it's a normal ship where you both have the agency related business and you also have the container businesses. Then, for instance, if it arrives in Port of Aarhus, you have to do the custom clearance people, you have the physical stevedoring meeting. You have to call the harbour that you need cranes, et cetera. You need your own manpower in terms of stevedoring, and you also need to align if there's a whole trucking company in bolt that has to eliminate it from the harbour into the infuser, so there would be approximately ten, what should we call it, stake holders in that one individual ship."

CCO, Shipping DK, 2018

During the operational phase, the agent prepares the cargo for transport. This involves 'getting the container' from the empty deport to be 'stuffed' and ready for transport. Once the cargo is 'loaded on a vessel', it departs the port of origin and sails for the next port of call. Port authorities are highly dependent on 'vessel operators' for their vessel journey details, specifically from a high overview insight from vessel operators and agents concerning their logistical planning. This is so that they develop more infrastructure, thereby attracting more cargo connectivity through the port to the rest of Europe's hinterland. As stated by the CFO of the ADP port, its essential to utilise port infrastructure and transport capacity optimally:

"How do we optimise the use of transport capacity? Bring that together with the ships ... I know that ships right now as we're speaking that sail right close by us out here ... they might have plenty of open capacity for containers that it may be headed to Hamburg. At the same time I have 50,000 trucks going past out here right now that's also going to Hamburg with goods. Why don't they drop it off here ... if they knew that there was a capacity out there that was cheaper ... just as easy. If they could have that transparency in real time, it would make sense for a ship to instead of going straight up to Strait, take a left going to Fredericia, pick up these containers ... it makes sense for these trucks as well to drop off the containers

> here ... so that would be fine. It's cheaper, it's better for everybody, and we utilize capacity that's already there."
>
> *The CFO of ADP, 2017*

For the port authorities, 'vessel arrival' and 'discharge from vessel' are the most important phases. This is when they receive digital resources for berth allocations, crane bookings, and jack up requests from agents, stevedores and vessels. Development and investment funding for the port authorities from the municipality is dependent on the volume of potential cargo or vessels which call into the port every year. As such, it is essential that the Danish port authorities provide an efficient service to all three port actors, as outlined below by one of their representatives.

> "Basically, the market must decide who will survive and who will not. It's a part of the development in the cities, etc., In combination, that you need larger scale investment in the ports because it's very important to have the latest crane or to build quay with deeper draft and it all depends on certain volume of cargo, etc."
>
> *CEO, Danish Port Association, 2017*

Following vessel discharge, the LPM also provides insights into the steps undertaken by agents concerning hinterland connectivity. This is where the port authority involvement ends vis a vis digital resource sharing, although 'accessibility to hinterland connectivity' is one of the competitive advantages that can contribute to port competitiveness. However, due to port law regulation, they are not allowed to be involved in this section of the LPM. Once the vessel discharges, the cargo is picked up by truck, or in some instance by rail, to transport it to either a hinterland warehouse for storage, or to the final destination. This step is generally known as 'load on inland transport'.

> "Mostly the agents will contact the truck operator with the ETA of a cargo pick up. But sometimes the agents are asked to store it in a warehouse or storing facility, we charge extra for that… that's done by my colleague … another agent because it now hinterland part of the chain."
>
> *CCO, Shipping.dk, 2017*

In the logistical process, to execute the 'load on inland transport' step, the agents, terminal and stevedore communicate the gate or the pick-up time to the truck operators. This part of the processes generally encompasses 'accessibility of hinterland'. A port that has rapid accessibility to the hinterland or inland are more favoured by cargo owners. The truck operator is highly dependent on the time of pick-up, which if inaccurate can lead to an increase in waiting time at the port, thereby increasing the cost for the cargo owner. Once the cargo is picked up by truck or rail, it is delivered inland to a warehouse for either long-term or short-term storage. One alternative is where the cargo is subsequently loaded onto another modality for long haulage to another country. Once the cargo arrives at its destination, it is known as 'inland transportation arrival'. The cargo is 'stripped' and checked for quality and any damages by the cargo owner. The final step of the operation is 'return equipment to the empty depot', which is carried out by the agent hired by the cargo owner. Regarding the finances, invoicing is the final step of the LPM, and is carried out by all port services providers. With respect to port authorities, this means ship dues and cargo dues. With respect to agents and stevedores, this means commission. With respect to vessels, this means carrier and shipping line charges. With respect to modalities, this means shipment charges.

7.4. HOW CAN THE PORT COMMUNITY EXCHNAGE DIGITAL RESCOURCES IN THE LOGISCIAL PROCESS MODEL?

The LPM is mapped with a potential 'digital platforms service' through which the Danish port authorities and other port community actors can exchange digital resources that have high dependencies with their interorganisational network. The port logistical model is divided into two parts: the digital resource exchange that can be governed under a neutral party, and the digital resources exchange which the Danish port authority can govern under the Danish Port Law (1999).

1) VESSEL NOTIFICATION

The vessel notification platform service can provide vessel captains or ship captains with a platform to submit all their compulsory documentation and notifications to the port authority (harbour master), including customs documentation and compulsory security ISPS information. This paper divides the vessel notification service into three parts, namely: 1) ship plan dashboards where the vessels can submit all their necessary documents and receive notification and pay invoices which are governed by the port authority; 2) port call optimisation booking of the cargo to the vessel until discharge, for invoicing the commodity dues and ship dues; and 3) berth request, planning and allocation, which provides berths to the ship Captain, and which is an internal process of the port authority.

A) Ship Plan

The ship plan customer dashboard (including invoicing) encompasses the whole logistical process model up to and including the invoicing of commodity and ship dues. There is a high dependency for these digital resources from both port control (harbour master), agents, stevedores, pilot tugboats, and linesmen. This is to try and reduce the administrative burden and decrease the waiting time regarding the confirmation and payment of invoices. This service just maps services which are only provided to the ship captain. This service can be fully governed by the port authority, but if it is to reach its optimal capability, it can be governed by a neutral party.

> "We are in the process of dealing with a company that has created parts of a (vessel plan) platform that is a little bit like what I'm describing. It just inhabits the ship element in it. We're trying to incorporate that into it. We're trying to create the platform. There is nobody that has the total information about the vessel's journey. But you see, if you get a platform like this and you own it, you also want the data flows. All of a sudden, if you get access to that, you have a commodity that really can be used."
>
> *CFO, ADP, 2018*

Ship plan execution is highly dependent on digital resources from the agents (representing the vessel and the cargo owner) and stevedores (representing the shipper, agent and the carrier). The advantages of exchanging these resources digitally are outlined below:

- The aim of the ship plan is to decrease the amount of time it takes to generate an invoice based on the operation, type of cargo, and special discounts. The invoicing information would be collected from the platforms of various port authorities, such as port call optimisation, port maps, and CRM.
- This ship plan would highlight the steps which vessels have to go through when arriving in the Danish port. Digital resources would be used on a high level and be connected to the Navision software (Havn, 2000) and to business intelligence (BI) in order to gather insights for annual reports, budgets accounting, and turnovers.
- The ship plans can assist vessel captains and cargo owners to easily transfer ship call to another agent, and doesn't have to fill in or provide the same information all over again.

B) Port call optimisation

Port call optimisation encompasses the vessel logistics process model in all its different stages, from the booking of the cargo to the vessel until discharge, to invoicing the commodity and ship dues. The aim of port call optimisation is to automate this scope by providing a platform to port users to exchange the digital information, insights and capabilities that are crucial for the survival of the port authority. Pilots and tugs are highly dependent on the digital resources from the agents (representing the carrier and the cargo owner). As such, Danish port authorities have high dependencies on these digital resources. It is crucial that port authorities build a relationship-based transparency and trust based interaction with both agents and stevedores. This service to reach its optimal capability it should be governed by a neutral party. This should also reflect in port authorities' digital platforms so that they can exchange digital resources without questioning their intention, as explained below:

> "But the port should not invent some complicated electronic platform where they suddenly want the master to enter all data. Those data are already delivered to someone else (agents and stevedores), and it should not be doubled."
>
> *Director, Danish Shipbrokers Association, 2018*

Port call optimisation execution is highly dependent on digital resources from the agents (representing the vessel and the cargo owner), the port authority (providing the berth and crane allocation details), and stevedores (representing the shipper, agent, and the carrier). The advantages of exchanging these resources digitally are outlined below:

- Port call optimisation provides value by providing a digital alternative to agents who communicate to all their various clients by phone and email.
- Port call optimisation provides value to terminals by integrating into their terminal operating system.

- It provides transparency to port authorities but also protects commercially-sensitive information about agents and cargo owners.

C) Berth request and request allocation

Berth request and allocation is a service where agents or stevedores can request the port authority for a berth on behalf of the ship captain to carry out the loading and unloading of the vessel. This is the official responsibility of the port authority under Danish port law. To optimise this process, the port authority is dependent on receiving information such as the ETA, cargo type, and type of vessel information – information which is generally owned by stevedores and agents. Most of the time, these bookings are done by phone and updated by email, which frequently creates challenges to the port authority in terms of optimising their berth allocation planning.

> "We need ETA information from the agent. We need it 72 hours … before the ship arrives, but most of the time we receive a call from the agent that the vessel will arrive in the morning."
>
> *Assistant Harbour Master, Port of Eastbjerg*

Berth allocation execution is highly dependent on the digital resources from the agents (representing the vessel and the shipper) and stevedores (representing the shipper, agent and the carrier). This service can be fully governed by the port authority. The advantages of exchanging these resources digitally are outlined below:

- The berth allocation platform provides value capture for agents to provide their vessel details, namely the ETA, ship name, and ship size. Digital resources will be also used for mobile crane booking requests. This decreases the administration burden for agents.
- The berth allocation platform also captures value for receiving information about the loading and unloading of the offshore wind installation, i.e. berth number, the actual time of arrival for the crane operation (e.g. loading the nacelles or wings on the installation vessel), or the actual time and location of the vessel departure. This provides efficiency for the stevedores in terms of loading and unloading the nacelles and wings, from truck to installation vessel.
- The berth allocation platform also gathers all the information for calculating the ship dues and commodity dues. This provides efficiency in terms of port performance for invoicing customers, and decreases the administrative burdens for ship captains and agents.

2) CRANE BOOKING AND ALLOCATION

Crane request and allocation is a service where stevedores can request a mobile crane owned by the port authority to carry out the loading and unloading of a vessel. This is the official responsibility of the port authority under Danish port law. To optimise this process, the port authority is dependent on information such as vessel ETA, cargo type, expected time of operation, draught needed for the vessel, and type of vessel information – information which is generally owned by stevedores and agents. Most of the time this booking is done by phone and updated by email. Similar to berth booking, this often creates challenges to the port authority to also optimise their berth allocation planning. This service should be governed by a port authority if they own the mobile cranes; if not, then it will be governed by the private supplier who owns them. The quotation below illustrates this:

> "That's also digitalisation, all the cranes and the web programme for booking. We are going with just a simple thing booking page, of course, From now on it's only digitalisation. Talking about going paperless in salary scripts now, we don't want to receive anything in paper any longer."
>
> *CFO, Port of Esbjerg, 2018*

Crane booking and allocation execution is highly dependent on the digital resources from the agents (representing the vessel and the shipper) and stevedores (representing the shipper, agent, and the carrier). Advantages for exchanging these specific resources digitally are as follows:

- The crane booking platform provides value capture for agents to provide their vessel details, namely the ETA, ship name and ship in their berth allocation platform while undertaking the vessel arrival procedure. This decreases the administration burden for stevedores.
- The crane booking system concentrates all the dispersed information and enquiries from the stevedores and agents about the crane booking status, and provides it in one place;
- Dynamic status with live updated information for all port actors would give opportunities to each actor to provide their feedback early – i.e. at the planning rather than the execution stage. This would also reduce the manual process of the crane driver having to submit the hours used by the stevedore, and then also submitting their own registration of hourly work to the financial department for confirmation.

3) MODALITY LOADING AND UNLOADING NOTIFICATION

The modality loading and unloading service is a single planform where all three modalities receive notification on their pick-up of the cargo time and location as well as request for unloading of cargo. It will provide modalities like truck and train information regarding the vessel ETA, the expected movement of the cargo, or the expected time they can deliver the cargo for loading. This service should be governed by a neutral party. The quotation below illustrates this:

> "Most of the time my colleagues (agent) call the cargo owners to discuss the pick-up from the warehouse and then call truck team with the list of orders and pick up places. This is either a pick-up at the port or the warehouse."
>
> *Manger, DHL 2017*

Modality loading and unloading is highly dependent on the digital resources from the agents (representing the vessel and the shipper), truck operators (representing the cargo owner), train driver (representing the rail operator), port authority (providing mobile cranes and berth for vessel) and stevedores (representing the shipper, agent, and the carrier). The advantages of exchanging these resources digitally are outlined below:

- Modality loading and unloading can provide value to truck and rail operators by providing notification on the cargo availability to pick up, submitting documentation for cargo release, provide the real time ETA of the vessel, and cargo operation information to the truck operators.
- Modality loading and unloading can provide notification to agents concerning customs checks, the customs documents required, and cargo status (if there is any damage at the time of loading and unloading by the stevedores.
- Modality loading and unloading can connect their system to the terminal system and to the inland depots to plan their capacity.
- Modality loading and unloading also provides cargo owners with the status of their cargo if it has unloaded from the vessel, and the time the truck can pick it up from the port. This gives them an estimation of time when the cargo will arrive at the warehouse.

4) CARGO NOTIFICATION

The cargo notification service will provide a track and trace possibility for the cargo owners. This will track cargo from the time it is 'loaded on vessel' to the time it has reached its point of destination. This service will help the cargo owner plan their own internal production and manufacturing processes. Due to the nature of the digital resource exchange in cargo notification, this contributes to port competitiveness by providing transparency for the cargo owner, and therefore increasing the flow of cargo through that port. This service is highly dependent on commercial information, and should be governed by a neutral party. The quotation below from the shipping dk illustrates this clearly:

> "We (ports) should only focus ... We (ports) should only monitor. Is she on that pier? Have you started unloading? All that has to be at any given platform digitalised instead of what we do today. Well, under the assumption that we are colleagues, not competitors, we shouldn't hide any information from them (ports). There should be full transparency per se. Generally, the idea is everyone's software is under one umbrella so you can access any software and trace your cargo. I think we should call that the future. To the best of my knowledge, there is no Danish port operating that system because there is no regulation and rules."
>
> *CCO, Shipping DK, 2019*

Cargo Notification is highly dependent on the digital resources from the agents (representing the vessel and the shipper), truck operators (representing the cargo owner), train drivers (representing the rail operator), stevedores (representing the shipper, agent, and the carrier), inland depots (for arrival or departure of cargo on a modality) and warehouses (for temporary storing of cargo). The advantages of exchanging these resources digitally are outlined below:

- Cargo notification will provide track and trace to agents, cargo owners and exporters.

- Cargo notification can give them an insight into cargo owners and agents that the correct information has been uploaded by other agents, stevedores, truck operators, inland depots and warehouses.
- Cargo notification can provide information such as on customs block, customs release and damages registered to the cargo.

5) PORT MAPS

Port maps are highly dependent on the digital resources from the port authorities (descriptive super infrastructure information) and from infrastructure providers (representing the shipper, agent, stevedores, terminals and the vessel). Port maps consist of geographics information system (GIS) data that provide analysis which is mapped onto an interactive map of the ports. Danish port authorities have a low dependency on this type of digital resource because it is well-known amongst port authority employees. Port authorities have realised that this does, in fact, add to the administrative burden for agents and stevedores due to replicative visiting to several webpages to download these digital resources in the form of pdf. For example:

> "I parked some of the digitalisation projects before this (digitalisation strategy) came, put them on standby. So, we investigated these systems that was bought in, are they capable of share information to our customers? We have a lot of master data are this new system able to provide this information so that the stevedores don't call us to ask about crane capacity but just check it in our system or agents call us draft information".
>
> *CCO, ADP, 2018*

The advantages of exchanging these resources digitally are outlined below:

- Port maps provide foundation and structure to archive master data. Master data is information which is static in nature and generally consists of descriptions and characteristics of port infrastructure. This includes road dimensions, land side quay wall weight handling capacity or berth location, crane loading capacity and name, and draft availability.
- The port maps platform provides value capture for agents and stevedores to gain insights regarding the quay location as well as the draught and dredging status of a particular quay, thereby making it easier to plan an assignment. For instance, agents can request a berth for different vessels that are scheduled for back-to-back operations in close proximity to each other. This would help to reduce the waiting time and the fuel cost for stevedores to drive the cranes to the next quay location.
- The port maps platform also captures value for port control to keep track of their soundings, so that depth can be maintained in certain passages for safe vessel navigation into the harbour. Port maps can also provide information about the maximum length and beam of a specific part of the port (e.g. berth or turning basic locks).

- The port maps platform also provides an archival platform to map all contracts on the GIS map of the port and to highlight the areas such as offices or warehouses that are available for business rental.
- Other port authority services such as waste pick-up, water and electricity, and slack pick-up services, have moderate resource dependency for execution from vessels, agents and stevedores. These services should be included in the berth allocation booking platform.

In summary, this section demonstrates seven services where digital resources can be exchanged in the logistical process model. As illustrated by the LPM (3), from the proposed seven services, the port authority can govern berth allocation, crane allocation and port maps as a digital resource service under their legal and judicial role. However, the four services that contain highly sensitive information should be governed by a neutral party. Even though these four services, namely modality loading and unloading, cargo notification, vessel notification (port call optimisation), and ship plan, fall outside the scope of the legal and judicial role of the port authority, this still contributes to their port competitiveness because of the increased cargo flowing through the port, more ship visits, and higher ship dues. This paper argues that the port authority can be part of these services at a certain level, but their role has to be clearly defined and communicated to the rest of the logistical chain. In the next section, we further discuss the impact of port authorities' scope in terms of digital resource sharing under their legal and jurisdictional system.

8. DISCUSSION

This paper presents its contribution regarding the concept of digital resource sharing in inter-organisational network. This is followed by a presentation of a generic logistical process model that will enable future ports to map their ambitions with regards to creating a digital resource sharing project. This discussion section also discusses the impact of the legal and jurisdictional system on the port authority's intention to participate in digital resource sharing initiatives, as well as its role in the port community system. Finally, the discussion section makes a contribution to the role of external networks in digital resource sharing.

8.1. DEPENDENCIES OF DIGITAL RESOURCE SHARING

The paper presented the concept of digital resource sharing at the outset, arguing that the survival of port authorities survival was highly dependent on the resource sharing capability of the inter-organisational network. The paper presented an approach for resource sharing (Hakansson & Johanson, 1992) from the perspective of trust-based interaction (Nooteboom, 2002) and formal contractual-based interaction (Das & Teng, 1999). The findings suggest that in the logistical process, digital resource sharing has greater similarities to contractual-based resource sharing than trust-based resource sharing. Most of the resources that the port authority is highly dependent on are also resources that provide competitive advantage to other port actors, and therefore cannot be substituted. As such, they have significant control over who they share them with, why they share, and when they share. The paper proposes that to undertake digital resource exchange or sharing, they have to be under a contractual agreement and where a neutral entity is responsible for the governance.

This paper highlights the dependencies of each actor present in the inter-organisational network of the logistical model.

8.1.1. DEPENDENCIES

Shippers (Cargo owners)
A shipper's (cargo owner's) dependencies lie in tracing their cargo logistical process. Generally speaking, the shipper controls the information/ resources in the network, and is one of the main actors within the port's inter-organisational network. They share most of their contractual-based resources with the agent, and do not share much of their information based on trust interactions.

Agents (or forwarders)
An agent's resource dependencies lie in the information provided by shippers (cargo owners), terminals (or stevedores), inland transporters, port authorities and carriers. Agents receive most of their survival-dependent resources from cargo owners, stevedores and inland transporters in order to undertake activities such as booking consignments on the vessel, booking berth occupancy in port, and planning inland transportation. They have contractual-based resource sharing with carriers, inland transporters, and shippers, and trust-based resource sharing with stevedores and port authorities. They also have a legal and jurisdictional obligation under section 1 (1-6) of the Danish port law to share resources of certain types (ETA, vessel type and cargo type) with the port authority.

Carriers
A carrier's resource dependencies lie in the information provided by the agent, the port authority, and the pilot and tug operators. The carriers generally control most of the logistical information from the vessel leaving the port of origin to vessel discharge from the next port. They control most of their contractual-based resources sharing with the agent, and do not share much of their information based on trust interactions.

Port community system
The Port community system's resource dependencies lie across all the actors of the logistical process. They do not own any resources, but rather are provided resources by the actors to share to a wide range of port actors. They act as a natural third party that connects the whole system together. They have contractual-based resource sharing with the whole logistical chain, and do not share any of their information based on trust interactions.

Terminals
The terminal's (or stevedore's) resource dependencies lie in the information provided by carriers, agents, inland transporters, and port authorities. Generally speaking, the terminals control the essential information concerning the loading and unloading of cargo from the vessel. They have contractual-based resource sharing with the carriers and inland transport. They have trust-based resource sharing with agents and port authorities. They do not have a legal and jurisdictional obligation under section 1 (1-6) of the Danish port law to share resources of certain types (ETA, vessel type, and cargo type) with the port authority.

Inland operators

The inland operator's resource dependencies lie in the information provided by agents, stevedores, and port authorities. The inland operator is dependent on information detailing the arrival of the vessel from the agent, and the time for pick-up or loading of the cargo from the stevedore. They have contractual-based resources sharing with agents and stevedores.

Port authorities

The port authority's resource dependencies lie in the information provided by the shipper (cargo owner), terminal (or stevedore), inland transporter, agent, and carrier. The port authority receives most of their survival-dependent resources from agents and stevedores to implement activities such as planning berth allocation for the vessel, and planning scheduling of the crane delivery. They have contractual-based resource sharing with carriers, and trust-based resource sharing with stevedores and agents. They also have a legal and jurisdictional role under section 1 (1-6) of the Danish port law to share resources of certain types (berth and crane) with carriers and agents.

Nautical services

Nautical services' (tugs and pilots') resource dependencies lie in the information provided by agent, port authority, and carrier. They have contractual-based resource sharing with agents, and trust-based resource sharing with port authorities.

Port services

Port services' resource dependencies lie in the information provided by the agent and carrier. Port services are implemented by the port authority. The port authority receives most of their information from agents and stevedores to implement activities such as waste pick-up (section 21 (2)) or cleaning and removal (section 22 (2-3)). They have a legal and jurisdictional role under section 21 (1-6) of the Danish port law to receive resources of certain types (waste disposal notification) from the agents.

Consignees

Consignees' dependencies lie in tracing the logistical process of their cargo. The consignee generally controls the information / resources in the network and receives most of their survival dependent information from the shipper (cargo owner). Most of their contractual-based resources sharing is with the agent (import), and they do not share much of their information based on trust interactions.

8.2. LOGISTICAL PROCESS MODEL

This paper contributes the logistical process model (LPM) (Figure 13) that can be used by small-to-medium-sized port authorities to map their digital resource sharing and dependencies within their port community. The LPM is generic enough to map a port that handles different types of cargo and which are dependent on digital resources from a range of port actors. The LPM is divided into different components, namely commercial, ordering, operational and financial. The LPM analyses shippers, agents (or forwarders), carriers, the port community system, terminals, inland operators, port authorities, nautical services, port services and, finally, consignees. The model illustrates the presence of each actor within the port logistic model. In this paper, a port logistical model is used to map the digital resources shared by each actor in the logistical process.

Commercial

The commercial step of the LPM consists of 'orientation' and 'selection'. Orientation is where the shipper asks for a quotation for transporting cargo by sea from various agents and stevedores. The selection process begins with the shipper (cargo owner) receiving all the necessary quotes, scheduling and customer service offered by the agent. Based on this, the cargo owner selects the agent to represent the cargo.

Ordering

The ordering step of the LPM consists of 'booking' and 'documentation'. 'Booking' is a procedure where a carrier is contacted by the agent (representing a cargo owner or shipper) to book a spot in the vessel to transport goods from one port to another. The documentation step consists of preparing the document for the pre-arrival notification of the vessel. The agent has to coordinate the documentation process with the import agent, the cargo owner, the carrier, the port community system, and the port authority. An agent also has to coordinate the documentation with the inland operator.

Operational

There are 11 operational steps in the logistical process. The first operational step is when the agent books 'equipment from the empty depot', where the cargo will be contained during transportation. After this, the agents collect the cargo from the shipper and implement the process of 'stuffing' the cargo into the packaging (e.g. containers, pellets, or temperature-controlled barrels). Once the cargo is ready to transport, the agent 'loads the cargo on the vessel'. When all the cargo is loaded, the 'vessel is ready for departure'. The departure of the vessel is communicated to the agent by the carrier. The 'vessel arrives at the destination', where the import agent is ready to receive the cargo. The vessel arrival procedure consists of the port authority providing the berth and either the terminal or stevedores ready to 'discharge the cargo'. The inland operator stands ready to load the cargo for 'inland transport'. The 'inland transport' arrives at the destination of the cargo. This is communicated between the agent (import) and the port community system. Finally, the cargo is 'stripped' by the agent, and the 'equipment is delivered to the depot' for future use.

Financial

The final step of the logistical process model is invoicing. With regards to port authorities, ship dues and cargo dues are invoiced to the carrier. With regards to agents and stevedores, the commission is invoiced to the cargo owner. With regards to vessels, carrier and shipping line charges are invoiced to the cargo owner or agent. With regards to modalities, shipment charges are directed to the agent and cargo owner.

This LPM provides insight into the roles played by each actor in the port community system. This LPM can be used to map the digital resources shared, it can be mapped to highlight an actor's role, and it can be used by the port community to divide the role of digitalisation between the port community and the port authority.

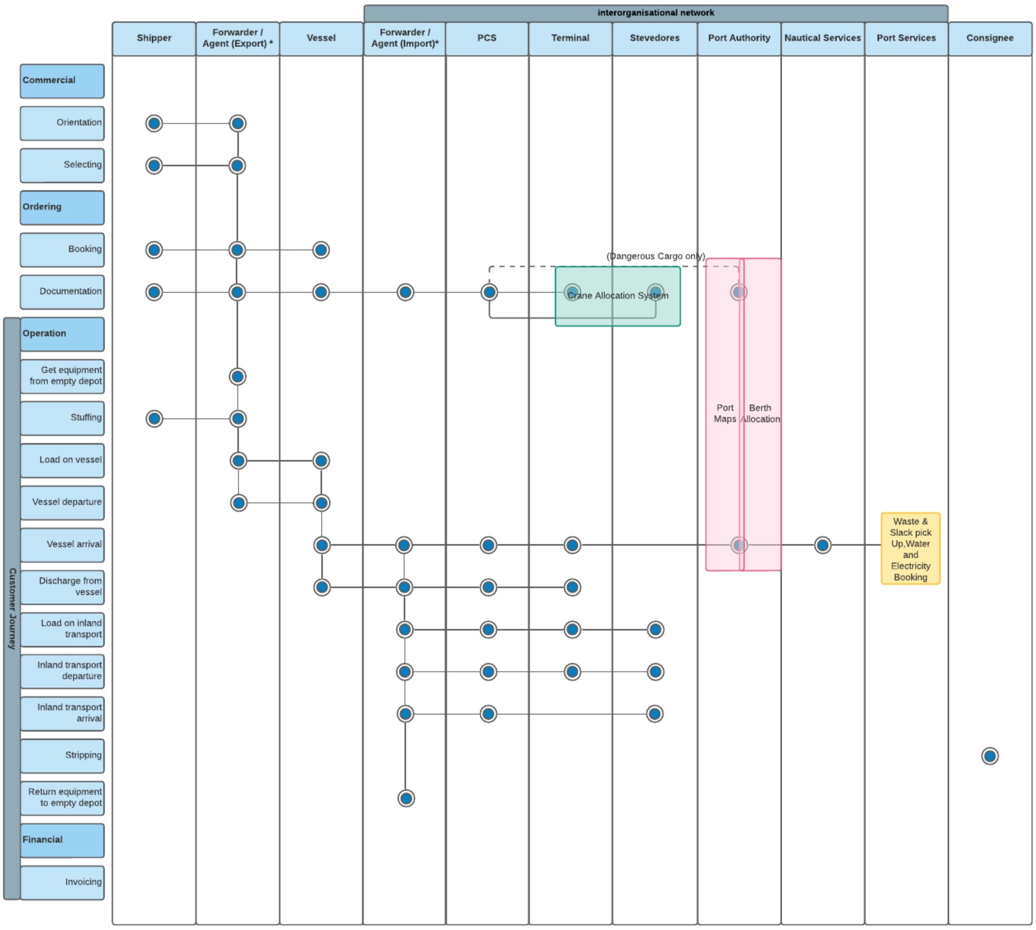
8.3.DANISH PORT LAW LIMITED TO PUBLIC SERVICE OBLIGATION

Danish port law consists of a governance structure that provides particular goals for the port authority, for example optimising infrastructure availability and optimising land use. However, there is no port governance classification which helps port authorities in their efforts to go paperless and digitally share resources. As stated above, ports are highly dependent on information which is owned by other port users. When these resources are not received in time, inefficiencies can be created, such as bottlenecks in logistical processes, which can eventually lead to the termination of small and medium-sized ports.

The LPM (Figure 14) show those areas where the port authority has the legal jurisdiction to exchange digital resources. Under the Danish Port Law of 1999, the port authority has the obligation to provide berths for each vessel which calls at the port. In addition, the port can provide infrastructure services such as mobile cranes and other services such as waste pick-up, electricity and water. This limits their scope to digital resource sharing in berth allocation, crane allocation, providing port infrastructure insights (e.g. port maps) and other port services. As outlined in the LPM, there are modality services, namely a loading and unloading service, cargo notification, vessel notification (port call optimisation), and ship plan. All these contribute to port competitiveness, and benefit the whole port community; however, the are outside the scope of the port authority. This means the opportunity for hinterland connection and inland port connectivity is lost, creating a challenge to the Danish port community as a whole. This challenge can, however, be solved with certain developments:

Role of the landlord port in the logistical process model (LMP)

All Danish port authorities should invest in digital resource exchange to optimise berth allocation, crane allocation, providing port infrastructure insights (e.g. port maps), and other port services. For instance, the port authorities in Denmark have already started investing in digitalisation projects such as a digital berth request and digital crane booking system. This digital project focuses predominantly on providing digital resource sharing opportunities up to the boundaries of port infrastructure, as stated in the port regulations for municipally self-governed ports such as Esbjerg, Køge and Aalborg. Municipally-owned limited companies such as ADP Port do have an edge, possessing an advantage over business enterprises since port regulations state that they can support and provide services for port users if there is no private actor ready to undertake the opportunity.



This diagram focusses only on: **container transport, merchant haulage, FCL, import into W-Europe via Danmark , requiring additional inland transport to hinterland!**
Inland transport into W.Europe, return to empty depot, and movements at the export side (UK/ASIA) are represented simplified.
All is seen from the Danish interorganisational network. – so PCS, Terminal, PortAuthority, Nautical Services and Port Services are Danmark - based.
*: For the Forwarder/Agent 2 identities are introduced: one representing the Export side (i.e.Asia); one representing the Import side in Danmark .

Figure 14:Logistical Process Model for Port Authority

Port community system

A collective collaboration should be undertaken by the Danish port authority and the external network to create a port community system that provides a neutral platform for all port users to exchange their digital resources. For instance, the Port Community System (PCS) is a platform built to connect all Danish port authority network processes, be they in digital, neutral, or automatic format. The collective collaboration of resource sharing is based on the contractual relationship of the network rather than trust. The contractual relationship of the port community system will have the attributes of traceability, monitoring and standardisation and will connect to other platforms such as the Port Authority Berth, crane allocation platforms, Maritime Single Window, and SafeSeaNet. With regards to traceability, the PCS can trace activity and cargo within the logistical process. Agents need to keep track of the uploaded documentation and the acceptance of the documents form. Simultaneously, the truck operator needs to track the ETA of the vessel and the loading / unloading status of the cargo. With respect to monitoring, the PCS can monitor the real-time movement of the cargo, as well as provide real-time information which can rectify errors and delays in planning operations. The port authority needs to monitor the vessels that call at the port in order to ensure the safety of the port. Similarly, the stevedore needs to monitor the arrival of the vessel to load and unload the cargo. With respect to standardisation, the PCS can provide standardised information to all actors in the port community. Finally, with respect to connectivity, the PCS can connect to the terminal system (Navis) or the port authority's system (Navision). It can also connect to the European Union's Single Window.

8.4. ROLE OF EXTERNAL NETWORKS IN THE PORT COMMUNITY SYSTEM

The Danish Port Authority has the knowledge and the connections to share critical resources at the national level. However, port users – in particular agents – are considered to have the power dynamics to inspire the port community to participate and collaborate with the port authority. For this paper, power dynamics are held by non-public actors such as agents, stevedores, vessel operators, lobbyists, policy makers and terminal operators, with shippers playing an important role in sharing information digitally. It is essential that Danish ports build a long-term, trusting relationship with these port actors. This can only be done if port governance or port law includes the digitalisation of information sharing (going paperless) as an official component of port governance, and there are clear guidelines about how it is governed. These sentiments are reflected by the Danish Shipbrokers Association, who represent shipbrokers, and also reflects the sentiment of the Danish Freight Forwarders Association, who represent freight forwarders.

Current port governance in Danish port authorities does not classify platforms which exchange digital resources as a port function (Merkel & Sløk-Madsen, 2019b). There is potential to regulate and formulate a whole new dimension based on digital resource exchange. However, this is not currently in the scope of the 1999 Danish Port Law. Until it is, the possibility remains that port authorities will face strong competition from competitors such as the Ports of Hamburg, Rotterdam, and Antwerp. In addition, ports in Finland and Norway have established models of how small and medium size ports can share digital resources in areas such as truck notification, port call process and cargo tracking in the supply chain. To increase the competitiveness of Danish ports, it is imperative that the external networks of agents, stevedores, vessel operators, lobbyists, policy makers and terminal operators, along with cargo owners, are assembled – and inspired – under a single platform that provides them with control, traceability, monitoring, standardisation and transparency. These attributes will make the port competitive, primarily by decreasing port users' administrative planning for pre-arrival procedures, customs clearance and the submission of compliancy documents to Maritime Single Window and SafeSeaNet. The most important role of this interface is to decrease the time and cost of the administrative burden for both port users and port service providers. This type of data structuring will give Danish port authorities the advantage to build new services for their customers, and to implement new ideas due to value shift. It will also help ports develop more personalised services for their customers.

The governance of the PCS cannot provide complete data transparency to the port authority because certain digital resources are company-specific, and may contain security information from the seaport police, customs procedures, marketing information, personal information, and commercially sensitive information. In most cases, when this information is not digitally shared, bottlenecks are created in the logistical process. There is a possibility that this information can be shared on a case-by-case bases with the port authority, but this is based on the discretion of the resource owner and their relationship with the port authority. As such, there are limitations to digital resource sharing even if the PCS is built in Denmark. This means that ports will never have full transparency in the LPM.

9. CONCLUSION

9.1. NEUTRAL PLATFROM FOR RESOURCE EXCHANGE IN THE DANISH PORT COMMUNITY.

This paper contributes the framework for the port community system that can make digital resource sharing possible in the Danish port community of landlord ports, and municipally self-governed or municipally-owned limited companies (Merkel & Sløk-Madsen, 2019a). This paper introduces the notion of neutral party digital resource sharing, which can solve the challenges faced by small-to-medium-sized ports. At the start of the paper, we discussed the challenges of (1) the limited resources and funds available with which to digitalise, and (2) how legal roles and responsibilities hinder small-to-medium-sized ports in digitally exchanging their resources. The neutral party can govern the areas that are not under the legal jurisdiction of the port authority. This will propel the development of digitalisation in the port community so that limited funds are invested by all the port community members, therefore hedging the risk evenly throughout the port community. This will result in the port having the potential to become more competitive. In this section, we contribute the services that can be offered by the PCS, which can implemented in a small-to-medium-sized port community.

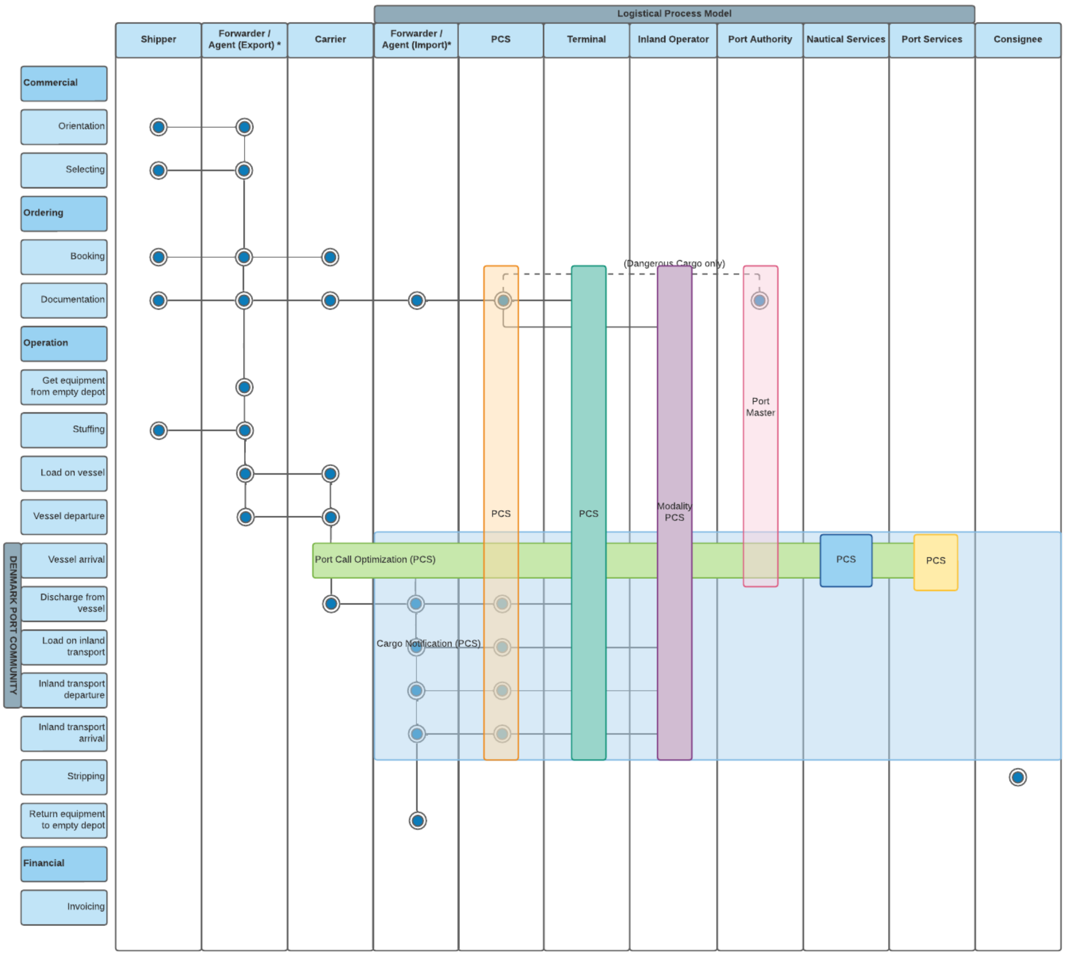


Figure 15:Logistical Process Model for PCS

Port call optimisation

In the PCS, the port call optimisation service will focus on the vessel arrival to the vessel until discharge. In addition, it also includes the invoicing procedure of the commodity dues and ship dues. The aim of port call optimisation will be to automate the pre-arrival procedure for the agents, which will include the port authority receiving the ETA information from the PCS, the terminal receiving the cargo information, and the carrier being able to request nautical services and port services. In contrast, port authorities, pilots and tugs are highly dependent on digital resources – on the information present in port call optimisation – and the accessibility of that information depends on the contract signed between the agents and the PCS.

Cargo notification

In the port community system, the cargo notification service will focus on the arrival of the vessel to the arrival of the cargo to the destination. This service is the most comprehensive one for the agents and the cargo owners to track the cargo and plan their internal processes and dependencies. Cargo notification is the most informative intensive service. The information is provided by the agents, terminal, inland operator, port authority nautical services, and port services to the consignee. This information is also highly important to the port authority. Similar to port call optimisation information, the accessibility of this information depends on the contract signed between agents, the terminal, inland transporters and carriers, and the PCS.

Terminal system connect to PCS
The terminal system is an external system owned by the terminal which can be connected to the PCS. The terminal ETA information is highly sought after by the port authority in the context of container cargo. The accessibility of this information depends on the contract signed between the terminal, carriers, and the PCS.

Modalities notification
In the PCS, the modalities notification service will focus on the inland transportation of the cargo. The modality notification tracks the truck or the rail transportation towards the port for loading the cargo, and follows it to the final destination of the warehouse or consignee. The modalities connect to the PCS following the booking step of providing documentation. This information is shared between the agent, terminal or stevedore, and the inland transportation. The modality arrival and departure information are needed by the terminal, stevedores and port authority to manage their dependencies for optimal port planning, but the accessibility of this information depends on the contract signed between inland transport operator and the port community system.

Port authority connected to Port community system
The port authority has the legal obligation to provide berths for the vessels. In this context the berth allocation and mobile crane allocation owned by the port authority can be connected to the PCS. The berth allocation (berth number and location) is highly sought after by the agents and the crane allocation (crane name and availability) is highly sought after by the stevedore. The accessibility of this information is based on the port law and the EU Single Window, and is available freely in the PCS.

Nautical services
In the PCS, pilots and tugs can provide their booking services for the vessels. This can be included as a functionality of the port call optimisation service.

Port services
The port services of waste pick-up, request for water, and request for onshore electricity can also be provided in the PCS, either by having a port service booking system or by connecting to the port authorities' internal port service booking system.

The port community will change subscription fees to users for using their services. These charges will be calculated based on comprehensive live data collected from various actors with regards to movement of cargo. There will be live monitoring of the vessel journey, providing insights into cargo movements, and giving information to the crane driver about how their planning can be scheduled. This information will be simultaneously transferred to the ship captain, agents, and stevedores. In turn, historical data will also be provided to agents, who can live stream or share these data to the ship owner and the cargo owner for insurance purposes, for the optimisation of cargo storage, and for data analysis. These data can also be used for real time sharing with the neutral PCS.

In addition, each port customer will receive a personalised service that will not only include the current services provided by the port, but also services with regards to raw data or data analysis to the customer. Agents like Shipping.dk, Jutlandia and Blue Water Shipping (BWS) can benefit from port digital infrastructure since their planning and scheduling can be combined under a formal agreement, where their data will be protected and will not be accessible to other parties without their consent. The value shift will inspire port authorities to move from a standard negotiated rent contract to one with personalised service packages, which include digital services and insights. Types of personalised service packages could include land and data packages, land and data packages with an additional technological component, or a Blockchain package.

There will be increased focus on the quality of data transparency and the efficiency of port performance as opposed to quantity. Stevedores, truck operators, and terminals that use port infrastructure will expect services beyond the existing basic levels of infrastructure and technology. They will prefer to have a digital booking, tracing, and analytical service, as well as a digital platform that provides all the information, instruction and confirmation. This transparency of data would equate to a 'transparency of need' from customers. There will be easy excess to information through formal contracts and data governance. Lastly, there will be a value shift from normal employees to digital experts.

10.LIMITATIONS

The 1999 Danish Port Law is under revision by the Danish port community. Therefore, any future Danish port law might consider the inclusion of digital resource sharing in the law, which would make a PCS redundant. As of now, port actors are strongly in favour of a Danish port community system. With respect to digital resource sharing, the paper focuses on the information and documents which need to be shared rather than the actual operations or sharing of physical infrastructure.

BIBLIOGRAPHY

Baird, A. J. (2000). Port Privatisation: Objectives, Extent, Process, and the UK Experience. *International Journal of Maritime Economics*, *2*(3), 177–194. https://doi.org/10.1057/ijme.2000.16

Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, *17*(1), 99–120.

Berg, R. V. den, & Langen, P. W. D. (2011). Hinterland strategies of port authorities: A case study of the port of Barcelona. *Research in Transportation Economics*, *33*(1), 6–14. https://doi.org/10.1016/j.retrec.2011.08.002

Bichou, K., & Gray, R. (2004). A logistics and supply chain management approach to port performance measurement. *Maritime Policy & Management*, *31*(1), 47–67. https://doi.org/10.1080/0308883032000174454

Brooks, M. R., & Cullinane, K. (2006a). Chapter 18 Governance Models Defined. *Research in Transportation Economics*, *17*, 405–435. https://doi.org/10.1016/s0739-8859(06)17018-3

Brooks, M. R., & Cullinane, K. (2006b). Chapter 18 Governance Models Defined. *Research in Transportation Economics*, *17*, 405–435. https://doi.org/10.1016/s0739-8859(06)17018-3

Brooks, M. R., & Pallis, A. A. (2008). Assessing port governance models: process and performance components. *Maritime Policy & Management*, *35*(4), 411–432. https://doi.org/10.1080/03088830802215060

Carbone, V., & Martino, M. D. (2003). The changing role of ports in supply-chain management: an empirical analysis. *Maritime Policy & Management*, *30*(4), 305–320. https://doi.org/10.1080/0308883032000145618

Celtekligil, K. (2020). Strategic Outlook for Innovative Work Behaviours, Interdisciplinary and Multidimensional Perspectives. *Contributions to Management Science*, 131–148. https://doi.org/10.1007/978-3-030-50131-0_7

Chang, Y.-T., Lee, S.-Y., & Tongzon, J. L. (2008). Port selection factors by shipping lines: Different perspectives between trunk liners and feeder service providers. *Marine Policy*, *32*(6), 877–885. https://doi.org/10.1016/j.marpol.2008.01.003

Cho, H. S. (2014). Determinants and Effects of Logistics Costs in Container Ports: The Transaction Cost Economics Perspective. *The Asian Journal of Shipping and Logistics*, *30*(2), 193–215. https://doi.org/10.1016/j.ajsl.2014.09.004

Das, T K, & Teng, B.-S. (1999). Managing risks in strategic alliances. *Academy of Management Perspectives*, *13*(4), 50–62. https://doi.org/10.5465/ame.1999.2570554

Das, Tushar K, & Teng, B.-S. (2000). A resource-based theory of strategic alliances. *Journal of Management*, *26*(1), 31–61.

Ding, X. H., & Huang, R. H. (2010). Effects of knowledge spillover on inter-organizational resource sharing decision in collaborative knowledge creation. *European Journal of Operational Research*, *201*(3), 949–959. https://doi.org/10.1016/j.ejor.2009.04.008

Dyer, J. H., & Singh, H. (1998). The relational view- Cooperative strategy and sources of interorganizational competitive advantage. *Academy of Management Journal*, 1–21.

Eisenhardt, K. M. (1989). Building theories from case study research. *Academy of Management Review*, *14*(4), 532–550.

Eisenhardt, K. M., & Schoonhoven, C. B. (1996). Resource-based view of strategic alliance formation: Strategic and social effects in entrepreneurial firms. *Organization Science*, *7*(2), 136–150.

Granovetter, M. (1985). Economic Action and Social Structure: The Problem of Embeddedness. *American Journal of Sociology*, *91*(3), 481–510. https://doi.org/10.1086/228311

Grant, R. M. (1991). Porter's 'competitive advantage of nations': an assessment. *Strategic Management Journal*, *12*(7), 535–548.

Håkansson, H., & Johanson, J. (1993). *The network as a governance structure: interfirm cooperation beyond markets and hierarchies*.

Håkansson, H., & Persson, G. (2004). Supply Chain Management: The Logic of Supply Chains and Networks. *The International Journal of Logistics Management*, *15*(1), 11–26. https://doi.org/10.1108/09574090410700202

Heaver, T, Meersman, H., Moglia, F., & Voorde, E. V. D. (2000). Do mergers and alliances influence European shipping and port competition? *Maritime Policy & Management*, *27*(4), 363–373. https://doi.org/10.1080/030888300416559

Heaver, T, Meersman, H., & Voorde, E. V. D. (2001). Co-operation and competition in international container transport: strategies for ports. *Maritime Policy & Management*, *28*(3), 293–305. https://doi.org/10.1080/03088830110055693

Heaver, Trevor. (2006). The Evolution and Challenges of Port Economics. *Research in Transportation Economics*, *16*, 11–41. https://doi.org/10.1016/s0739-8859(06)16002-3

Hillman, A. J., Withers, M. C., & Collins, B. J. (2009). Resource Dependence Theory: A Review. *Journal of Management*, *35*(6), 1404–1427. https://doi.org/10.1177/0149206309343469

Hollen, R. M. A., Bosch, F. A. J. V. D., & Volberda, H. W. (2014). *Strategic levers of port authorities for industrial ecosystem development*. *17*(1), 79–96. https://doi.org/10.1057/mel.2014.28

Horst, M. R. V. D., & Langen, P. W. D. (2008). Coordination in Hinterland Transport Chains: A Major Challenge for the Seaport Community. *Maritime Economics & Logistics*, *10*(1–2), 108–129. https://doi.org/10.1057/palgrave.mel.9100194

Kumar, R. S., & Pugazhendhi, S. (2012). Information Sharing in Supply Chains: An Overview. *Procedia Engineering*, *38*, 2147–2154. https://doi.org/10.1016/j.proeng.2012.06.258

Langen, D., & Nijdam, M. H. (2009). A best practice in cross-border cooperation: Copenhagen... - Google Scholar. *Transport and Mobility Series*. https://scholar.google.com/scholar?q=A+best+practice+in+cross-border+cooperation%3A+Copenhagen+Malm%C3%B6+Port

López, R. C., & Poole, N. (1998). Quality assurance in the maritime port logistics chain: the case of Valencia, Spain. *Supply Chain Management: An International Journal*, *3*(1), 33–44. https://doi.org/10.1108/13598549810200915

Lugt, L. V. der, Langen, P. D., & Hagdorn, L. (2015). Beyond the landlord: worldwide empirical analysis of port authority strategies. *International Journal of Shipping and Transport Logistics*, *7*(5), 570. https://doi.org/10.1504/ijstl.2015.072021

Lugt, L. van der, Dooms, M., & Parola, F. (2013). Strategy making by hybrid organizations: The case of the port authority. *Research in Transportation Business & Management*, *8*(C), 103–113. https://doi.org/10.1016/j.rtbm.2013.06.005

Madhok, A., Mellewigt, T., & Weibel, A. (2004). Trust and Formal Contracts in Interorganizational Relationships - Substitutes and Complements. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.611161

Marlow, P. B., & Casaca, A. C. P. (2003). Measuring lean ports performance. *International Journal of Transport Management*, *1*(4), 189–202. https://doi.org/10.1016/j.ijtm.2003.12.002

Marschan-Piekkari, R., & Welch, C. (2004). Qualitative research methods in international business: The state of the art. *Handbook of Qualitative Research Methods for International Business*, 5–24.

Martino, M. D., Carbone, V., & Morvillo, A. (2015). Value creation in the port: opening the boundaries to the market. *Maritime Policy & Management*, *42*(7), 682–698. https://doi.org/10.1080/03088839.2015.1078010

Martino, M. D., Errichiello, L., Marasco, A., & Morvillo, A. (2013). Logistics innovation in Seaports: An inter-organizational perspective. *Research in Transportation Business & Management*, *8*(C), 123–133. https://doi.org/10.1016/j.rtbm.2013.05.001

Martino, M. D., & Morvillo, A. (2008a). Activities, resources and inter-organizational relationships: key factors in port competitiveness. *Maritime Policy & Management*, *35*(6), 571–589.

Martino, M. D., & Morvillo, A. (2008b). Activities, resources and inter-organizational relationships: key factors in port competitiveness. *Maritime Policy & Management*, *35*(6), 571–589. https://doi.org/10.1080/03088830802469477

Martino, M. D., Morvillo, A., & Marasco, A. (2010). *Value Creation Within Port Supply Network: Methodological Issues*. 1–11. https://www.researchgate.net/profile/Marcella_De_Martino/publication/266216219_Value_Creation_Within_Port_Supply_Network_Methodological_Issues/links/54b90d830cf28faced6268ea.pdf

Merkel, A., & Sløk-Madsen, S. K. (2019a). Lessons from port sector regulatory reforms in Denmark: An analysis of port governance and institutional structure outcomes. *Transport Policy*, *78*, 31–41. https://doi.org/10.1016/j.tranpol.2019.03.010

Merkel, A., & Sløk-Madsen, S. K. (2019b). Lessons from port sector regulatory reforms in Denmark: An analysis of port governance and institutional structure outcomes. *Transport Policy*, *78*, 31–41. https://doi.org/10.1016/j.tranpol.2019.03.010

Miles, M. B., & Huberman, M. A. (1994). *Qualitative data analysis: An expanded sourcebook*.

Ng, A. K. Y., & Pallis, A. A. (2010). Port Governance Reforms in Diversified Institutional Frameworks: Generic Solutions, Implementation Asymmetries. *Environment and Planning A*, *42*(9), 2147–2167. https://doi.org/10.1068/a42514

Ng, K. Y. A. (2006). Assessing the Attractiveness of Ports in the North European Container Transhipment Market: An Agenda for Future Research in Port Competition. *Maritime Economics & Logistics*, *8*(3), 234–250. https://doi.org/10.1057/palgrave.mel.9100158

Nooteboom, B., & Six, F. (2003). *The Trust Process in Organizations*. https://doi.org/10.4337/9781843767350.00008

Paixão, A. C., & Marlow, P. B. (2003). Fourth generation ports – a question of agility? *International Journal of Physical Distribution & Logistics Management*, *33*(4), 355–376. https://doi.org/10.1108/09600030310478810

Parola, F., Ferrari, C., Tei, A., Satta, G., & Musso, E. (2017). Dealing with multi-scalar embeddedness and institutional divergence: Evidence from the renovation of Italian port governance. *Research in Transportation Business & Management*, *22*, 89–99. https://doi.org/10.1016/j.rtbm.2016.12.005

Pfeffer, J., & Leblebici, H. (1973). Executive Recruitment and the Development of Interfirm Organizations. *Administrative Science Quarterly*, *18*(4), 449. https://doi.org/10.2307/2392198

Pfeffer, J., & Salancik, G. R. (2003). *The external control of organizations: A resource dependence perspective*. http://www.worldcat.org/title/external-control-of-organizations-a-resource-dependence-perspective/oclc/992835078

Robinson, R. (2002). Ports as elements in value-driven chain systems: the new paradigm. *Maritime Policy & Management*, *29*(3), 241–255. https://doi.org/10.1080/03088830210132623

Rowley, J. (2002). Using case studies in research. *Management Research News*, *25*(1), 16–27. https://doi.org/10.1108/01409170210782990

Salancik, G. R., & Pfeffer, J. (1978). A social information processing approach to job attitudes and task design. *Administrative Science Quarterly*, 224–253.

Song, D.-W., & Panayides, P. M. (2008). Global supply chain and port/terminal: integration and competitiveness. *Maritime Policy & Management*, *35*(1), 73–87. https://doi.org/10.1080/03088830701848953

Soppé, M., Parola, F., & Frémont, A. (2009). Emerging inter-industry partnerships between shipping lines and stevedores: from rivalry to cooperation? *Journal of Transport Geography*, *17*(1), 10–20. https://doi.org/10.1016/j.jtrangeo.2008.04.006

Srivastava, R. K., Shervani, T. A., & Fahey, L. (1998). Market-Based Assets and Shareholder Value: A Framework for Analysis. *Journal of Marketing*, *62*(1), 2–18. https://doi.org/10.1177/002224299806200102

Stake, R. E. (1995). *The art of case study research*.

Szeto, E. (2000). Innovation capacity: working towards a mechanism for improving innovation within an inter-organizational network. *The TQM Magazine*, *12*(2), 149–158. https://doi.org/10.1108/09544780010318415

Thomas, G. (2011). A Typology for the Case Study in Social Science Following a Review of Definition, Discourse, and Structure. *Qualitative Inquiry*, *17*(6), 511–521. https://doi.org/10.1177/1077800411409884

Tijan, E., Jović, M., Panjako, A., & Žgaljić, D. (2021). The Role of Port Authority in Port Governance and Port Community System Implementation. *Sustainability*, *13*(5), 2795. https://doi.org/10.3390/su13052795

Tongzon, J., & Heng, W. (2005). Port privatization, efficiency and competitiveness: Some empirical evidence from container ports (terminals). *Transportation Research Part A: Policy and Practice*, *39*(5), 405–424. https://doi.org/10.1016/j.tra.2005.02.001

Tongzon, J. L. (2009). Port choice and freight forwarders. *Transportation Research Part E*, *45*(1), 186–195. https://doi.org/10.1016/j.tre.2008.02.004

Verhoeven, P. (2010). A review of port authority functions: towards a renaissance? *Maritime Policy & Management*, *37*(3), 247–270. https://doi.org/10.1080/03088831003700645

Wareham, J., Mathiassen, L., Rai, A., Straub, D., & Klein, R. (2005). The business value of digital supply networks: A program of research on the impacts of globalization. *Journal of International Management*, *11*(2), 201–227. https://doi.org/10.1016/j.intman.2005.03.007

Wernerfelt, B. (1984). A resource-based view of the firm. *Strategic Management Journal*, *5*(2), 171–180.

Yap, W. Y., & Lam, J. S. L. (2004). An interpretation of inter-container port relationships from the demand perspective. *Maritime Policy & Management*, *31*(4), 337–355. https://doi.org/10.1080/0308883042000259729

Yi, D. W., Kim, S. H., Choi, H. R., Park, N.-K., & Lee, T.-W. (2000). Developing a conceptual model for sharing container terminal resources: a case study of the Gamman container terminal. *Maritime Policy & Management*, *27*(2), 155–167.

Yin. (2003). *Case Study Research Design and Methods.* 3rd Edition, Sage, Thousand Oaks. https://www.scirp.org/(S(lz5mqp453edsnp55rrgjct55))/reference/ReferencesPapers.aspx?ReferenceID=1994558

Yin, R. K. (1994). Discovering the future of the case study. Method in evaluation research. *Evaluation Practice*, *15*(3), 283–290.

Yin, R. K. (2009). Case study research: Design and methods (applied social research methods). *London and Singapore: Sage*.

Zhang, Q., Geerlings, H., Makhloufi, A. E., & Chen, S. (2018). Who governs and what is governed in port governance: A review study. *Transport Policy*, *64*, 51–60. https://doi.org/10.1016/j.tranpol.2018.01.019

Zhang, Q., Zheng, S., Geerlings, H., & Makhloufi, A. E. (2019). Port governance revisited_ How to govern and for what purpose? *Transport Policy*, *77*, 46–57. https://doi.org/10.1016/j.tranpol.2019.03.001

Note

- Håkansson, H., & Snehota, I. (1995). Developing relationships in business networks. London: routledge.
- Håkansson, H., & Johanson, J. (1992). A model of industrial networks.
- Easton, Geoff. 1998. Case Research as a Methodology for Industrial Network:
- A Realist Approach. In Network Dynamics in Marketing, ed. Peter Naudé, and Peter W. Turnbull, 73–87. Oxford: Pergamon Press.

APPLICATION OF DIGITALISATION IN LANDLORD PORTS TO ACHIEVE EFFICIENCY IN PORT PERFORMANCE

ABSTRACT

PURPOSE

Despite the lack of research concentrating how digitalisation contributes to improvements in structural network centrality and port performance, recent times have seen an increased focus in port performance. This has resulted in Danish port authorities moving quickly in the direction of port digitalisation. This raises the question as to how small and medium-sized ports can digitalise, what methodology they should use, and what value it adds to their own business as well as the value it adds to port actors (i.e. port users and service providers). Specifically, it begs the question as to how a port authority can develop a digital platform to improve the structural embeddedness of networks for efficient port performance. Given this, the main objective of this paper is to answer these questions by creating a digital artifact to improve the network centrality for information availability, thereby achieving efficient port performance.

DESIGN/METHODOLOGY

Considering the above, and the need to investigate how port actors contribute to performance indicators, this paper explores the question of how an artifact contributes to improving port performance efficiency. It uses a combined methodology of case study, design science and action research. It is argued that where the structural embeddedness of the network is denser, key information sharing, information availability and accessibility to technology accelerates. This can be realised through the development of new information systems for sharing "information" that would create "efficiency' in port performance through the implementation of an intuitive business process. Using the structural embeddedness framework created by (Gnyawali and Madhavan, 2001), this paper studies the variables of network centrality and network density in the context of Danish port authorities. For this research, longitudinal data between 2016 and 2019 were collected and subsequently analysed using three different research methods. Case study method was used to recognise the relevant problem of inefficiency in the berth and crane booking processes in the Port of Esbjerg. The design science framework (Hevner *et al.*, 2004) was then used to design an artifact that would reconfigure the processes of booking berths and cranes into a 'one place one decision' platform that creates efficiency for port call optimisation port performance.

FINDINGS

In terms of outcomes, this paper contributes an artifact, namely a berth and crane allocation platform, which is more customer-focused and creates denser network centrality. This helps the network engage in a more 'efficient' performance when allocating berths and cranes to specific vessels. In addition, the outcome contributes towards "information availability", which plays an integral part in attempts to improve port performance efficiency. In particular, it decreases the administrative burden, increases participation with the port's central network (both central and non-central), increases the bargaining power of the competitors, increases participation between various central actors to reach balanced network centrality, and increases the number of central actors in the network.

VALUE OF THE PAPER

Danish port law legally allows functions and responsibilities which focus on operational-related services (i.e. providing infrastructure, entering into cooperative agreements with other ports, providing crane and warehousing services, and providing ship-related services) whereas digital related services (i.e. port call optimisation, data sharing plans and efficiency related platforms) were overlooked, with just 'day-to-day administration' being mentioned. This paper provides a methodology which can be adopted by Danish port authorities in order to optimise their daily business processes. This is achieved by digitalising and simultaneously optimising their internal performance in relation to vessel berth and crane allocation, and also building a positive collaborative effect with other port actors which is based on transparency and trust in the port centrality network. This paper indicates how small and medium-sized Danish port authorities can invest in digitalisation under legally allowed port laws, capturing value for port performance by increasing efficiency in both berth allocation and crane booking procedures. Due to the general nature of the artifact, all 30 Danish ports which are municipally self-governed could digitalise using the contributed artifact.

Keywords: Digitalisation, berth /crane allocation, efficiency, port performance, network centrality, Design science

1. INTRODUCTION AND OVERVIEW OF THE PAPER

As the world has digitalised, ports have struggled to understand their role in the supply chain. There are many users within the supply chain, amongst whom information is shared and operations are executed, with management occasionally deciding to digitalise their processes so as to explore new dimensions of efficiency. Unfortunately, however, not all users see the need for accelerated digitalisation, which results in a slower overall pace of digitalisation. When considering the fact that all these users have the same aspiration when digitalising their processes, namely, to be more efficient, it is crucial that all ports – whether as service provider, commercial port, or port authority – require a clear definition of their own role in order to avoid supply chain disruption.

Service-oriented port authorities have a well-defined judicial role that maps the boundaries of port call optimisation, intra-port operation and hinterland accessibility for the cargo; however, as a service provider, the port has a broader role which affords the port greater opportunity to digitalise their processes in comparison to a landlord port. Despite this, the digitalisation framework has yet to be finalised and has not been defined in the context of port services. This makes digitalisation a 'learn fast fail fast' process, and as such an expensive endeavour. The port authorities are service oriented ports that have to communicate their investment plans to their shareholders, therefore limiting the funds which ports can spend on such endeavours.

This gap emphasises the need to conceptualise and evaluate how digitalisation can contribute to the port authority's processes. So that this paper has the highest possible impact, research is drawn from the port efficiency and port performance literature, using information about key indicators which can result in port optimisation. This provides us with a starting point for our digitalisation journey. From the perspective of the port authority, the focus is on the scope drawn by the boundaries of the responsibility, which is predominantly port call notification[8], dangerous cargo notification[9] and vessel inspection[10]. From the commercial perspective, one of the greatest challenges is identifying the specific scope or area of operations requiring efficiency while simultaneously improving the performance of all port users. This has to be achieved without compromising the position of any of the users, and providing continuous opportunities for growth in similar contexts. With this intention in mind, we take guidance from port performance indicators that establish the boundaries of where ports can develop internal processes that improve the port's competitiveness. The objective is to develop an artifact that will translate port services into efficient outcomes that can be standardised to other small-to-medium-sized ports.

Previous research conducted by (Duru *et al.*, 2020) noted that various port performance indicators have been pursued by different bodies, but each were limited in some way. Similarly, the recent literature has argued that port competitiveness required more research focused on efficiency in port-offered services, with technical efficiencies rather than service-based efficiencies having been overlooked. These limitations have generally been linked to quantifying the results while maintaining a space for components of qualitative methodology such as case study, design science and action research design science. This research, however, has focused on investigating the inefficiencies experienced by port authority focused services, which can be used as prerequisites for scoping the digitalisation needs. This leads to us deciding to explore a three-step longitudinal study to assess the problem and investigate the findings as the results are being produced. To investigate this even more deeply, this paper examines the perspective of port competitiveness literature related to efficiency in port authority related performance.

2. OVERVIEW OF THE MAP

The Figure (16) below presents an overview of the paper. The paper encompasses three years of longitudinal study, which is divided into three parts according to its analytical focus. Each analysis

[8]Port call notification is defined as the procedure whereby agents call the port on behalf of the vessel for the allocation of a berth for loading and unloading cargo.
[9] Dangerous cargo notification is defined as informing the harbour master about dangerous cargo or hazardous cargo onboard the vessel.
[10] Vessel inspection is a procedure where the harbour master checks the internal and external condition of a ship.

follows a unique, specific methodology so as to answer the research questions. The outcome of these analyses are condensed later in the 'contribution' section.

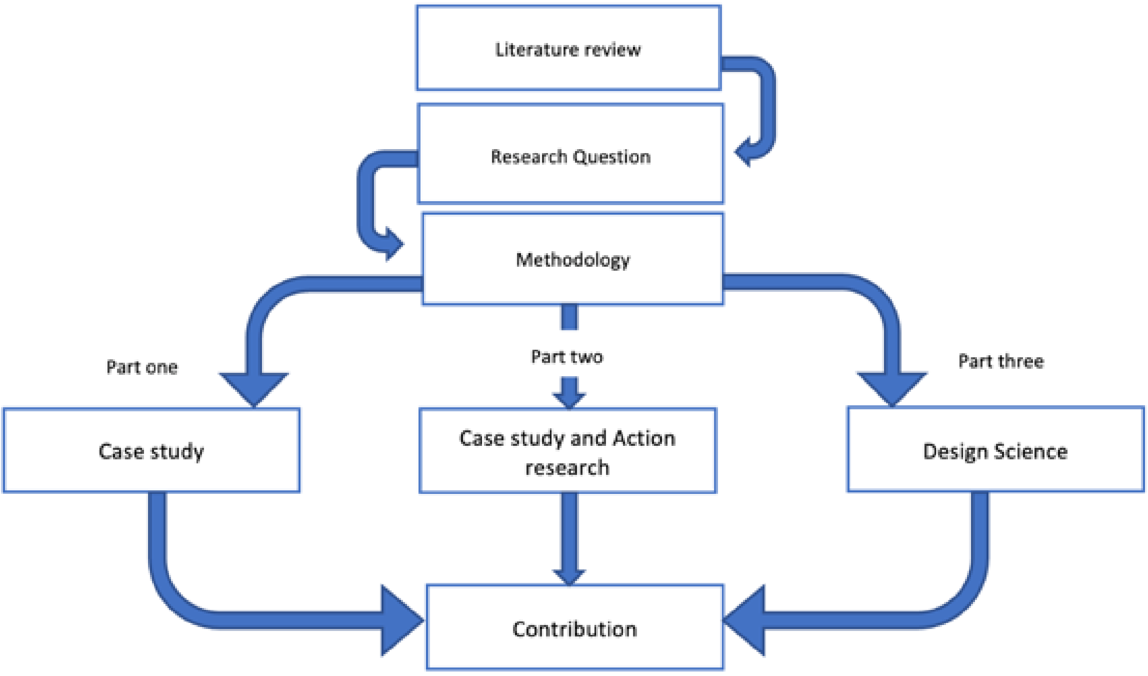


Figure 16: Overview of the Paper

3. LITERATURE REVIEW

3.1. PORT COMPITATIVENESS FROM THE EFFICIENCY PRESPECTIVE

Port competitiveness is the degree of attractiveness to which it competes with other port competitors. Attractiveness can be defined as the efficiency that the port provides in their services, the selection of cargo it can handle and its geographical position. A recent literature review undertaken by (Chang and Talley, 2019) emphasised the limited focus on research methods used in the port competitiveness literature. They argue that most traditional port competitiveness literature assesses technical efficiencies, creating a gap for more research on service-oriented competitiveness in efficiency studies (ibid.). Most theory and methodology explains efficiency as a numerical form of measurement (Lirn *et al.*, 2004; Song and Panayides, 2008; Tongzon and Ganesalingam, 2007; Wanke *et al.*, 2011; Yuen *et al.*, 2013). Although each efficiency indicator contains value to be either created or captured by a different port actor, most of the research on port performance focuses on quantifying the efficiency rather than recognising the methodology of efficiency wherein the intention is to improve the processes that support the performance. This paper argues that this is where the gap lies. The majority of the efficiency research focuses on a specific actor. Tongzon and Ganesalingam (2007), for example, present high-level efficiency indicators in berth, crane, and storage areas. Similarly, (Tongzon and Heng, 2005; Tongzon and Ganesalingam, 2007) presents terminal efficiency as a vital component for the survival of port performance. (Lirn *et al.*, 2004) develop 47 relevant transhipment service attributes that are considered for port selection.

These service attributes or criteria comprise different aspects of port performance for a sole actor rather than the whole supply chain (Chang and Talley, 2019). This paper examines port competitiveness based on the efficiency of its services provided by an embedded network of port actors rather than measuring the technical efficiencies of the delivery of the cargo by the port actor. This is another factor which influenced our meticulous focus on different port authority-based services, where actors contribute to different form of criteria. This also indicates the trend of focusing on attributes than function.

The overall aim of this study is to provide a new perspective about how to improve efficiency that increases port competitiveness across the whole port network or supply chain rather than just for a single actor. One example concerning the improvement of a port network is (Wanke *et al.*, 2011), which focused on the determinants of efficiency with a special focus on the development of the market in terms of private or state control efficiency. Similarly, (Martino and Morvillo, 2008) studied port competitiveness through the lens of client need satisfaction, noting that ports have a proactive role in supply chain construction. Although these contexts have been previously considered by a range of scholars (Brooks and Pallis, 2008; Song and Panayides, 2008; Tongzon and Ganesalingam, 2007),there is no research where the methodology has been applied in a context where these port functions or operations are transitioning into a digitalisation-focused entities.

Through the digitalisation of operational business processes, the port authority can bring together a range of decentralised key information sharing processes, hitherto inefficient, in order to optimise their defined port performances. The effect of this is to considerably increase their efficiency. Port efficiency determinants are influenced depending on the ownership of the ports and their judicial role. This paper highlights the need for a new lens to optimise the efficiency of port performance when the concepts of control, competition and integration are in the process of change. The result of this has been a growing gap in understanding between the actors in this hybrid organisation and those who are developing a new form of digital platform to improve their performance indicators, resulting in the port becoming more competitive compared to other ports. Considering this, this paper presents an opportunity to redefine efficiency in port competitiveness, addressing the fact that whilst the existing literature has argued that efficiency evaluation is always measurable, it is also important to recognise the value of the efficiency through non-measurable variables.

To contribute to port competitiveness from the port network perspective, this paper investigates the port actor's relationship with other port actors along with the port authority, and the extent to which they are interconnected and how they interact with each other. These kinds of interaction are conceptualised as structural embeddedness (Granovetter, 1985; Nahapiet and Ghoshal, 1998) where a denser network density provides an environment for information availability in the supply chain (Gnyawali and Madhavan, 2001; Long and Chen, 2021). One main form of interaction which can be analysed is the daily core operation which gives ports authorities their strategic advantage (Notteboom *et al.*, 2013; Notteboom and Winkelmans, 2001; Verhoeven, 2010); Notteboom et al., 2013). When considering the strategic value for port competitiveness in port authorities, port call optimisation is of the utmost importance. Taking port call optimisation as a focal point, embeddedness can be used to understand the importance of a port actor contributing towards the port authority provided services of berth allocation, crane booking, and truck arrival procedures, as well as the users needed to accomplish the strategic efficient port performance, namely stevedores, agents, and ship captains. Narrowing this further, this paper argues that port competitiveness improves as a result of the participation of central actors achieving high structural embeddedness and collaboration between competitors, thereby improving the overall efficiency of port performance.

3.1.1. DEFINING EFFICIENCY FOR PORT AUTHORITIES

This paper argues that an increase in efficiency of port performance increases port competitiveness across the whole supply chain. As argued above, efficiency should not be measured on the output of a single actor but rather from the perspective of a collective supply chain. Nevertheless, most of the port performance literature (Acosta *et al.*, 2007; Johnson and Styhre, 2015; Song and Panayides, 2008) demonstrates that the contribution to efficiency of port users such as agents, stevedores, terminals, and ship captains can be studied from the perspective of a single actor rather than from the supply chain perspective. The majority of the supply chain literature is studied from a physical or operational rather than service-oriented perspective (Lam and Yap, 2011; Talley, 2013; Talley *et al.*, 2014; Talley and Ng, 2013, 2022). The closest which the research has come to studying a port as a service provider in the supply chain is (Talley *et al.*, 2014) in which the port is considered in terms of service for vessels and stevedores, and other mobility services.

This paper diverges from this research perspective, proposing instead to study efficiency realised collectively by the port supply chain. The port network shares information across the supply chain in order to update, inform, book, and enquire about operations. This exclusion of the study of port authority managed services in the supply chain is an oversight in the efficiency literature research (Chang and Talley, 2019). Some of existing port level research studies customer-based efficiency through the overall cost incurred by the customer (Lam and Yap, 2006), and how it attracts new customers by attracting investors (Hales and Lam, 2019). Despite this, a gap remains in the port competitiveness literature, and it is important to capture the essence of efficiency in the supply chain by focusing on the port authority provided service.

In addition to providing basic infrastructure for various actors, the port authority also provides services such as allocating berths, crane rental, waste pick up, the cleaning of berths after operation, and water and electricity for the vessel. They are also the first point of contact for general enquiries and emergencies within the port network. Even though the port authority is accessible to every actor in the supply chain, not every actor is available to the port authority. This creates a challenge to the port authority as it tries to increase its competitiveness by being efficient in providing their services to port actors. To be efficient in their services, the port authority requires access to information. Access to key information at the right time can lead to outcomes including efficient planning, efficient use of infrastructure and efficient operations. In a port authority's network, most of the supply chain information is held by agents, most of the operational information is held by stevedores and most of the vessel arrival and departure information is held by ship owners[11] or shippers[12]. This creates a need to improve the accessibility of information for the port authority from the port authorities' network, resulting in our view that the efficiency of port-provided services can be achieved through greater information accessibility. Moreover, we argue that accessibility of information, transparency of information, the density of the network and the frequency of the network can also improve port competitiveness.

In brief, our assumption is that greater efficiency in these areas can be achieved if the information were to be made available in a uniform and standardised way, where there is a single unambiguous truth. However, creating a single unambiguous truth for multiple actors can be challenging, especially if the information is distributed in a non-transparent manual process. Therefore, it is essential to improve the processes that have been developed in order to make this information accessible. This is why this paper proposes the digitalisation of processes that are manual in nature, and has this as a core objective. We argue that the digitalising processes of port-related services will make information more accessible to the port authority.

4. RESEARCH QUESTION

The focus of this paper is on port authorities, port service providers, and port users. It investigates how each presents a different perspective of the challenges of port efficiency. The main objective of the paper is to investigate how key customer-centric port services can be optimised through digitalisation. In trying to achieve this objective, this paper begins by looking at the scope of digitalisation, asking the question as to how a port authority can increase access to information, which in turn improves the structural embeddedness of the network as well as realising port competitiveness. In doing this, this paper is structured as outlined below.

To answer the question 'How can port authorities achieve efficiency in their port performance through digitalisation and increase structural embeddedness in their network?', the investigation needs to be broken down into three parts.

d) What are the indicators that are under the port authorities' judicial role which contribute to port performance efficiency?
e) What are the challenges faced by port authorities in increasing port networks' density?
f) How can port authorities increase information accessibility so that it contributes to the efficiency of port authorities' performance?

In order to investigate the research objective of this paper, the main research question is divided into three sub questions. The research question is further analysed using a three-part research methodology which is extended in a longitudinal study.

[11] Ship owners own the shipping lines and either have their own vessel or chatter vessel to transport cargo by the sea. In Denmark they are collectively part of the Danish Shipowners' Association.

[12] The shipper is the owner of the goods being transported from one port to another

5. METHODOLOGY: THREE ROADS COMBINE INTO ONE

5.1. LONGITUDINAL STUDY

The unique features of longitudinal research provides this paper with the opportunity to combine three methodologies for data collection and analysis which can help address the research question. This section summarises the journey of the researcher in collecting the data as well as the physical movement of the researcher in different environments. The researcher journey focuses on the port authority as a unit of analysis and employs a qualitative methodology as a source to answer the question of "how".

This paper is influenced by Miles and Huberman (1994) in terms of how qualitative research is understood and implemented. It notes that qualitative data should be considered as rich in description and detailed in its explanation of processes occurring within the context(Miles and Huberman, 1994). Taking the scope (i.e. the port authority's different port performance indicators) and research context (i.e. access to data, documents, and organisation) into consideration, the possibility of fruitful explanation, assessing low causality and preserving chronological flow can support the researcher. Specifically, this paper uses a longitudinal study, which is defined as "a research study that repeats observation repetitively over a period, sometimes over decades."

Because of the nature of the author's involvement as a research consultant in 2018-2019, this paper uses an action research method to iterate the artifact from collected feedback. This enables an evaluation of the artifact built within the framework of the design science method. This iterative process between development and evaluation is non-linear due to the abductive approach of this research. To establish the applicability of the case study, design science and action research application, this paper highlights the best practice adopted by the author.

The Table (11) below illustrates the longitudinal research design for this research, which encompasses the researcher's data collection journey over a period of three years. For this research, as can be seen, the author collected longitudinal data between 2016 and 2019 with a range of experts in their particular field. The data consist mainly of primary structured interviews and field work undertaken at the end of the research period (2018-9).

Table 11:Overview of data collection and unit of analysis

Research Design	Data Collection method	Data Source
December 2016 – December 2017	*Interviews* - 28 structured in-depth interviews - Two secondary interviews	- Port Authority - Danish Port Companies Association - DHL - Shipping.DK - Danish Port Association - Finnish Port Association - Swedish Port Association

		- Danish Ship Broker - Danish Freight Forwarding Association
January 2018 – December 2018	*Interviews* - 38 structured interviews *Workshops* - Three Workshops *Presentations* - Four presentations	- Port Authority - Ship Broker Association - Danish Freight Association - Danish Port Association - Danish Shipping Association - DHL - Shipping.DK - Danish Safe Sea net - Freight Forwarding Company
January 2018 - March 2019	- Field Notes - Field Visits - Participant observation - Work Focus groups	- Port of Esbjerg - Port of Koge - Danish Port Association - Danish Shipping Association - Freight Forwarding company

5.2. CASE STUDY

A case study is defined by Huberman and Miles (1994) as "a phenomenon occurring in a bounded context" and by (Yin, 2003) as "as an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident." Furthermore, a case study can be understood as a qualitative study that follows the parameters of a predefined question (Yin 2003). A case study is therefore suitable for efficiency research, where we need to have detailed information about a complex network of information. Such a situation could be an in-depth investigation of processes between port control and various vessel agents, the purpose of which is to try and understand why some ship call operations work while some do not. To achieve this, different cases or scenarios must be studied in order to recognise patterns. A case study approach does, however, have certain limitations, specifically: (1) it is difficult to attain scope, and to design a case study which adequately answers broadly defined questions; (2) a good and vigorous case study depends on accessibility to areas that are sensitive or restrictive within an organisation; (3) a case study is often considered to lack rigour with regards to the validity of findings. Taking all these points into consideration, our overall research design should not be limited only to a case study, but should rather focus on more applicable research action research. Such an approach would provide an opportunity to conceptualise and illustrate human action within their business processes. Structural embeddedness research can be investigated through a combination of multiple studies to answer our research question. This research case study method can be used to investigate the scope of this project, along with action research, to define the phenomenon of structural embeddedness and to highlight the reasons for its low-density network. This can then be further expanded as an input for building artifacts.

5.3. ACTION RESEARCH

Action Research (AR) is defined by (Bell *et al.*, 2018) as an approach where an action researcher and a member of an organisation collaborate, within a specific environment, to diagnose a problem and, based on this diagnosis, work together towards a solution. (Eden and Huxham, 1996) described AR as being when a researcher work with a person from an organisation to try and find a solution for an issue of concern which the organisation is prepared to take action about. AR considers the world as constantly changing, and that both the researcher and the research being undertaken are part of that change. Given this, AR is suitable for network embeddedness research as it can help our understanding of the complexity of network information sharing when executing an operation or highlighting a problem which needs to be solved collectively. Doing so will make performance more efficient, or bring the community together so that they feel emboldened to apply change collectively. Most of the issues that contribute to operational inefficiency lie in a 'point' of collective steps which can be only recognised if the researcher immerses themselves in observation. Critics of AR argue that it is predominantly an organisational development technique used by consultants (Baskerville, 1999) and that it is incumbent on the researcher to avoid bias and conflict of interest (Avison *et al.*, 1999)). Taking this into consideration, the research design used here should not be limited only to AR, but rather combined with case study research (Analysis part two). This will result in the collection of systematic data for coding from a theoretical lens, with the case study providing an in-depth investigation of area under investigation.

5.4. DESIGN SCIENCE

Design Science research is defined by (Hevner *et al.*, 2004) as a "problem-solving paradigm that seeks to create innovations that define the ideas, practices, technical capabilities, and products through which the analysis, design, implementation, and use of information systems can be effectively and efficiently accomplished." It is generally used to understand the performance of an artifact, providing insights in terms of how an information system can be better executed (ibid.). Types of artifacts include the interaction of human/computer interfaces, system design methodologies, algorithms, or languages (Orlikowski and Iacono, 2001). These artifacts are introduced into environments with the intent of solving a problem, and through the processes of evaluation, iteration, and assessment the efficacy of the artifact is determined (March and Smith, 1995). Therefore, design science is used for the in-depth study of an artifact which is created through increasing network density. For example, with central actors, if the researcher aims to improve information sharing between different parties for the proper execution of operations, this will require designing the artifact to make that possible, continuously iterating the artifact and being open to receiving feedback for its improvement.

The design science research method was then applied to further develop the theory, namely: design the artifact, apply it to the problem, evaluate the design, and communicate the contribution. This was achieved using an artifact that supports both collaboration and participation from various sources to improve the information sharing of port-related business processes. Design science is further used to make decisions related to designing and evaluating the artifact that will result in increasing the network density and neutralising the power of the centrality so that the chosen port performance can create value. Design science contains five steps emerging from the work of several authors, which have subsequently been transformed into six steps, given the nature of the longitudinal nature of data collection and analyses (see (Hevner *et al.*, 2004; Hevner and Chatterjee, 2010; Peffers *et al.*, 2007; University *et al.*, 2013).

5.4.1. BUILDING THE ARTIFACT AND PROBLEM RELEVANCE

The objective of the design science research is to develop a technology-based artifact that provides a solution to the problem discovered.

5.4.2. DESIGN EVALUATION

The quality, efficacy and applicability of the artifact should be evaluated. This means also to evaluate if the artifact can be implemented in the present IT infrastructure, if the information gathered is translated into the artifact the artifact consists of all functionalities that is needed to solve the problem.

5.4.3. RESEARCH CONTRIBUTION AND RESEARCH RIGOUR

The contribution of the artifact can be that, having created a knowledge base, it can simplify a complex problem or build an algorithm. This research contribution can follow a methodology which is experimental, analytical, observational, testing, or descriptive. The research rigour focuses on the data collection method of producing a viable artifact.

5.4.4. DESIGN AS A SEARCH PROCESS

The artifact search processes iterate the artifact until a desired end is realised, whereby all the functionality attributes and elements which need to be present *are* present, and can satisfy the problem. This step involves the iteration of the artifact until a consensus is formed with the users, the port authority and port users whilst remaining true to the design science framework.

5.4.5. COMMUNICATION OF RESEARCH

The artifact should be presented to both management-oriented and technology-oriented audiences. Management-oriented communication determines whether the organisation will provide commitment to its creation, providing it with the necessary resources for its construction. Technology-oriented communication is needed for discussing the applicability of the artifact, and whether the technological capacity is sufficiently mature to build it within the context.

5.5. APPLICATION OF THE THREE RESEARCH METHODS

The longitudinal study expanded over three years of data collection and analysis. The case study data was collected and analysed between February 2017 and December 2017 while the action research methodology and artifact design was carried out between January 2018 and March 2019 through an iterative process. The author was later hired as a research consultant in 2018-9 to provide their expertise on digitalisation, at which time data were simultaneously collected through 70 structured interviews, three workshops and four presentations with relevant port network actors. Due to the nature of our self-involvement as a research consultant, the researcher firstly studied the data collected from the Port of Esbjerg in order to build an artifact through the lens of design science research.

Secondly, this was then iterated with feedback received through the Port of Koge, from workshops with the port community, and via presentations in various stakeholder meetings. Due to the nature of the author's involvement as a research consultant in 2018-2019, this paper uses the action research method to illustrate the density of the network and then to iterate the density of the network. Collected feedback from the development of the artifact was then used to evaluate the artifact which was built within the framework of the design science method. This process between development and evaluation was non-linear due to the abductive approach of this research.

5.6. RESEARCH PHILOSOPHY

This paper follows Thomas, (2011) that the analysis of selected port actors provide a rich illustration of the interdependencies and analytical insight from the perspective of C-level management on network centrality and the potential of exchange of essential information amongst port actors (Thomas, 2011). There remains the possibility that the selected port actors are insufficient for providing the research with valid arguments. Our aim is to emphasise that our positivist research paradigm and the case selection criteria should follow a literal replicated logic (where the case presents similar outcomes) or a theoretical replication logic (where the case presents different outcomes) (Rowley, 2002; Yin, 2003). We also note the importance of accomplishing theoretical saturation in our enquiry (Eisenhardt, 1989)Secondly, we aim to pursue "generalisation at the theoretical propositional level and not to population or universe" (Yin, 2009: 21).

5.7. DATA COLLECTION OVERVIEW

The data collection process spanned three years. It was collected and analysed between February 2017 and December 2017. The action research methodology and artifact design was carried out between January 2018 and March 2019 through an iterative process. This involved conducting interviews, studying documents, and undertaking observations, a process which suggests triangulation (Yin 2009; Thomas 2011). The interviews conducted with C-level management were the main source of information, with document analysis and observations being used to support and add more information to the interview about specific port performance indicators. As regards these indicators, information was exchanged by the port actors as a way of confirming via interview that the data had an actual presence in their physical business.

5.8. INTERVIEW METHOD

We planned the interview method in such a way to gather as much rich, detailed, qualitative information from experts as possible. This approach was based on the explorative nature of this study as well as the opportunity to conduct the study longitudinally. There were instances where some interviews provided more insights concerning the port's central actors, and the information which they exchanged with each other. In total, 67 interviews were conducted, all of which were conducted onsite at the business premises of the interviewees. The snowball sampling method in Babbie (2012) answers the question of "whom" to interview next was used. This was achieved by asking the interviewee to either: (1) in the case of the port authority to suggest the next potential colleague who has the expert knowledge in our area of interest; or (2) in the case of the port service provider or user, to suggest the company they maintain important communications with.

5.9. OPEN-ENDED QUESTIONARIES

A literature review focused on a theoretical analysis of port performance indicators was used to format the interview questions. Particular focus was given to the context of collaborative port projects, and how digital work can be used to progress ideas. During the interviews, it was assumed that essential information transfer with customers would highlight communication with the Danish Port Authority, their manual procedures for accomplishing specific port performances and, in some cases, good examples of the challenges faced by the Danish Port Authority with regards to digital resources. The questions were purposefully abstruse with regards to challenges of manual procedures, meaning that interviewees could not change the narrative into one which was more positive. Interviewees were also asked to describe their important business processes, the central actors they communicate with to gather information, and the steps they need to take should there be a problem or inquiry. We saw that interviewees were open to supplying us with comprehensive knowledge about the relationships they felt were important for port performance. This was, for example, in terms of the form of communication they generated, their customer survey satisfaction report, and the feedback received to improve their work in delivering efficient port performance.

5.10. DATA TRIANGULATION

To achieve data triangulation in our data collection and to obtain more comprehensive insights, for each type of port central actor we interviewed more than one interview. With regards to port authorities, the goal is to illustrate the link that port authorities are dependent on transferring important information to provide efficient port performance. For this reason, C-level management were interviewed in order to gain a comprehensive perspective on the ambition of port authorities to improve in specific areas of performance, such as port call procedure. This includes the vessel berth allocation process, cargo loading and unloading operations, waste disposal, slap oil pickup, crew change, and provision for vessel crew and equipment maintenance. It also includes mobile crane rentals for stevedores to load and unload offshore or project cargo, warehouse rentals for the storing of cargo, and land rental for offices. In the case of port authorities, it was possible to interview all C-level management and mid-level employees within the companies' networks. However, due to the comprehensive nature of the qualitative data and the in-depth explanation of the source, a pseudonym is used to provide anonymity to the port authority. This is due to the digital nature of the central network and the digital nature of the artifact. Our concerns are based on previous experience of hacking of the same port authority and other maritime companies, such as Maersk. As regards associations, in-depth interviews were carried out with the director / CEO of the Danish Port Association, the Danish Shipbrokers Association, the Danish Port Companies Association and the Danish Freight Association, as well as with representatives from DHL, Shipping DK and two Transport companies. Two of these were also board directors of the Danish Port Companies Association.

6. CODING AND DATA ANALYSIS

Coding was undertaken twice over a twelve-month period, a process which consisted of reading and reflecting on the transcript, coding the data, and reflecting on it and refining it. The data were analysed using the reduction, display and verification processes outlined in Miles and Huberman (1994). First, the transcripts were prepared for coding using a template following the template analysis in Kings et al., (2012). The code was created based on the structural embeddedness's network centrality literature and the port performance literature, as already noted above. In total 67 interview transcripts, field notes, observations and documents were analysed (see Table 12). The coding process was undertaken using NVivo. Our pathway to analysis was guided by the steps outlined in Kings et al., (2012), and consists of reading and reflecting the transcript, coding the data, and reflecting on it and refining it. The data analysis was divided into three different parts based on the research type. As illustrated in the Table (12) below, the coding was divided into three coding cycles.

Table 12:Application of Research Method

Analysis	Application of Research Method	Data Type	Data Source
Part One	Case study	- 40 structured in-depth interviews - Two Secondary interviews	- Port Authority - Danish Port Companies Association - DHL - Shipping.DK - Danish Port Association - Finnish Port Association - Swedish Port Association - Danish Ship Broker - Danish Freight Forwarding Association Port - Authority - Ship Broker Association - Danish Freight Association - Danish Port Association - Danish Shipping Association - DHL - Shipping.DK - Danish SafeSeaNet - Freight Forwarding Company
Part Two	Case and action research	- 40 structured in-depth interviews - Two Secondary interviews Field Visits	- Port Authority - Danish Port Companies Association - DHL - Shipping.DK - Danish Port Association - Finnish Port Association - Swedish Port Association - Danish Ship Broker

		Participant observation Work Focus groups	- Danish Freight Forwarding Association Port Authority - Ship Broker Association - Danish Freight Association - Danish Shipping Association - DHL - Shipping.DK - Danish SafeSeaNet - Freight Forwarding Company - Technical Department - Harbour Control - Crane Operators - Financial Department - Maritime Department - Executive Management (C-Level) - Agents - Stevedores - Pilots Technical Department - Harbour Control - Crane Operators - Financial Department - Maritime Department
Part three	Design science	- 70 structured interviews - Three Workshops - Four presentations	- Technical Department - Harbour Control - Crane Operators - Financial Department - Maritime Department - Executive Management (C-Level) - Agents - Stevedores - Pilots Technical Department - Harbour Control - Crane Operators - Financial Department - Maritime Department

6.1. PART ONE: CASE DATA

The total data collection process spanned more than three years, addressing the research question 'What are the indicators that under the port authorities' judicial role contributes to port performance efficiency?

The case study data were collected and analysed between December 2016 and December 2017. The process involved conducting interviews, studying documents, and undertaking observations, suggesting that triangulation was central (Thomas, 2011; Yin, 2009). C-level management interviewees were the main source of information, with document analysis and observations being used to support and add more information to the interview about the specific port roles and functions. The case study enabled an in-depth understanding of the boundaries of the port authority, and the assumptions of how the port community conceptualises the boundaries the port authority. The difference in opinions provided by the research into scoping the boundaries of the port seem to concern whether they are based on judicial law or on the delineation of a service-oriented port.

6.1.1. CODING

In part one of the analysis, NVivo coding was used for the interviews collected. NVivo coding is also known as *literal* coding, and is used in this case to identify the terms and assumptions of different port actors with regards to port boundaries. The research question focuses on '*What'* are the indicators that under the port authorities' judicial role contributes to port performance efficiency. NVivo coding was undertaken to highlight the keywords used by interviewees for specific questions, specifically regarding the indicators use to measure the efficiency of port performance. These indicators could then be isolated and translated into the business process, highlighting the way in which central actors communicate, access information, and transfer information.

6.2. PART TWO: ACTION RESEARCH AND CASE STUDY

Research Question: What are the challenges faced by the port authority to increase port networks density? To answer this question, data were collected between January 2018 and December 2018, with the analysis being divided into action research and case study research.

Initially, using the freedom of action research, the approach adopted was to follow port control in their journey of gathering information from various actors, systems, and conversations. We established the roles which existed at the boundaries of the port authority, in particular internal and external interaction in both allocating cranes and berth services. As a consultant, I separated my approach into mapping the problem diagnosis by following the daily conversations encountered by port control with a range of actors, and condensing this conversation into "LINK' between two actors. I then interviewed these links to further investigate their strength in the network, access to knowledge and issues which they might experience. Each LINK had two actors at either end of the link, where one actor (who controlled the key information) transferred the information to the other actor on the other side of the LINK. These LINKs were then mapped as an illustration to demonstrate the density of the network, and was subsequently used as an 'intervention' to gather feedback and start a conversation between port control and other port users. In the future, it could be used to highlight redundant links which could be easily solved or replaced. Some of these conversations led to in-depth interviews while others resulted in operational visits, for example spending 24 hours at the port control office or visiting the crane operation at the berth. These insights helped us reflect on our learning, and contributed to our ability to investigate in more detail.

Based on the network illustration, further in-depth interviews were carried out to understand the network density of the two business processes. These interviews focused on the challenges faced by actors while sharing information. In this context, the case study constituted an in-depth study of the movement of each link which, when combined, increases understanding of the network in terms of business processes or indicators. The investigation also includes actors from port control, the technical department, and the financial department so as to map the contributions of each actor in the business processes with regards to the berth and crane allocation procedure. In addition, the inclusion of perspectives from indirect stakeholders constituted interviews on the business process of crane and berth allocation, who were asked to state their expectations of the business process. The result of this investigation contributed to greater illustration of both the berth allocation business process and the crane allocation business process, along with their challenges, and a discussion of redundant and non-redundant business processes.

6.2.1. CODE

Value coding was used in order to illustrate LINK, i.e. the interactions between actors. For example, any interviewee who used the word "capacity" was coded as value coding for Quay Capacity. Interviews consisting of words such as "space", "availability" and "operation stopped" were coded under Quayside Space and Crane Allocation. Similarly, "quay allocation" and "berth allocation" were coded under Berth Allocation.

Pattern coding is used as second cycle coding to group the input from various actors in berth and crane allocation cases. Along with the value coding, we used pattern coding to illustrate the interacting between actors by grouping them in clusters of: 1) actors (sub-coded as agent, stevedore, linesman, ship captain and port control etc.); 2) action; and 3) problem (sub-coded as administrative burden, accesses to information, transparency, vessel berthing and crane operation delay).

Pattern coding was used to highlight the interaction of central actors in communicating information. This coding was also used to illustrate the link between central actors. Pattern coding highlighted the links between different central and non-central actors, as well as the interaction, key information shared, and problems faced by different port actors.

6.3. PART THREE: DESIGN SCIENCE

How can a port authority increase information accessibility that contributes to efficiency of port authorities' performance?

The design science data were collected and analysed between January 2018 and March 2019. With the problem relevance established in PART TWO of the analysis, this paper adopts the design science framework to investigate the business processes deemed the most essential following the case study and action research analysis (Hevner et al., 2004; Peffers et al., 2007; Hevner & Chatterjee, 2010; Gregor & Hevner, 2013). The objective of design science is to produce an artifact that assists the port authority transition from a manual accounting application to a customised digital platform. Design science uses a six-step framework to produce an artifact that solves those problems recognised in Part Two of the analysis, an artifact which creates an environment for the port authority to access information. Case study methodology provided insights for the three steps of the design science (i.e. Evaluation (step 3), Research Contribution (step 4), and Research Rigour (step 5)). The case study methodology is used to further improve the illustration provided in part two of the analysis, that is to highlight the research contribution of the artifact and to collect data which proves the value of the artifact.

6.3.1. CODE

Value coding was used in the methodology section of the Evaluation, Research Contribution, and Research Rigour design science steps. If the interview consisted of phrases such as "vessel is allocated", "optimal berth", "draft level", "correct draught" and "vessel waiting", it was coded under Vessel Berthing. Any words like "valuable", "capacity" and "occupied" were coded under Berth Capacity. Phrases such as "mobile crane", "location change", "we wait", "stevedore call the other stevedore" and "sharing" were coded under the Mobile Crane term.

Table 13: Research Method and Coding

Research Method	Timeline	Data	CODING
Case study research	2017	- 40 structured in-depth interviews - Two Secondary interviews	- NVivo coding
Design Science	2018	- 70 structured interviews - Three Workshops - Four presentations	- Pattern coding - Value coding
Action Research	2018 - 2019	- Interview - Field Visits - Participant observation - Work Focus groups	- Value coding

7. ANALYSIS PART ONE : CASE STUDY

This paper studies the case of the Port of Esbjerg, a small-to-medium sized port in Denmark. The Port of Esbjerg is a Nordic port situated in Jutland, and contains one of the biggest offshore wind installations in Europe. It also provides services to the Danish oil and gas industry, and has established itself as the Northern European hub for RoRo Cargo. More than 200 companies rent land across its 14 km of quayside. The port authority consists of approximately 60 professionals, and in 2019 had an annual revenue of EUR 9.13 million.

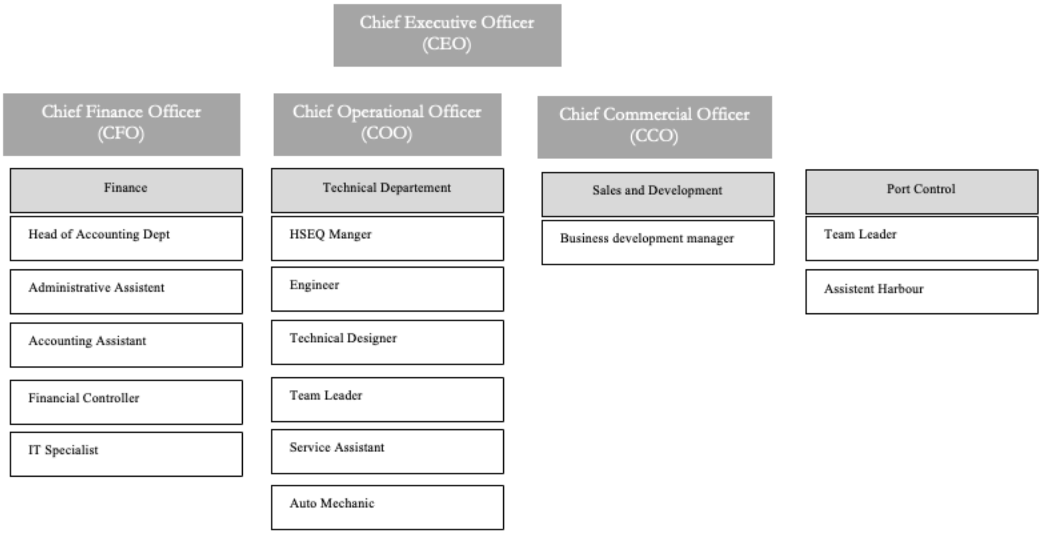


Figure 17: Organisational Chart of Port of Esbjerg

7.1. MANAGEMENT

As can be seen in the organisational chart above (Figure 17), the Port of Esbjerg has a top management level consisting of four C-level positions, namely: Chief Executive Officer (CEO); Chief Finance Officer (CFO); Chief Operational Officer (COO). Chief Commercial Officer (CCO). The roles and responsibilities of each executive member of the port are explained below, clarifying the way in which each department interacts with the port community.

- Port Control Department

The Port Control Department is steered by the Chief Operational Officer (COO), and consists of ten assistant harbour masters under a team leader. They focus on berth allocation planning, the shifting of berth procedure, the crane booking schedule, and daily communications with vessel captains through VTS. They must comply with the ISPS, and are responsible for the overall safety and security of the port. In addition, they work closely with the sales and development department to provide the right information to prospective customers for vessel jack up and long-term anchorage of offshore platforms. Externally, they communicate and coordinate with agents, freight forwarders, stevedores, ship captains, truck drivers, and truck operators.

- Sales and Development Department

The Sales and Development Department is steered by the Chief Commercial Officer (CCO), and consists of a business development manager and temporary research assistants. Their role is to find new market parties to rent out the quayside or landside on a long-term basis. They also focus on sales for vessel jack up, oil rig long-term berthing, and modality shift. On the operations side, they work on competing for tenders regarding cargo projects. They focus on new business opportunities and study market trends. They also contribute specific carrier information to the port control department for offshore planning, specifically concerning berth allocation planning and anchorage planning. Externally, they communicate and coordinate with the port association, shipping associations, shippers, sales managers, long term renters, carriers, offshore platform owners, project cargo operators (e.g., offshore installation projects), and ship owners.

- Finance Department

The Finance Department is steered by the Chief Finance Officer (CFO), and consists of an accounting assistant, finance controller, IT specialist, and the head of the accounting department. There are seven employees in total. They are responsible for updating the rental contracts, preparing ship dues, and sending out due invoices for cranes. They are also responsible for organising the annual report. Externally, they communicate and coordinate with shareholders, press, municipalities, agents, freight forwarders, stevedores, and tenants.

- Technical Department

The Technical Department is steered by the Chief Operational Officer (COO), and consists of engineers, technical designers, a team leader, service assistants, and auto mechanics. The department consists of 25 employees. Their main responsibility concerns port development and assets maintenance. In terms of port development, they are responsible for legal assessment, environmental assessment, and project cost management for superstructure such as quay walls, land, roads, and bridges. In terms of maintenance, they are responsible for the quay, pipelines, roads, gates, and cranes. Externally, they communicate and coordinate with the municipality, the association of transport construction and housing, tenants, and vessels.

7.2. PORT COMMUNITY

In this paper, in terms of scope, the port community is considered as that which is directly part of the network density. Within the network are port users and port service providers. Port users are those central actors who visit the port, and use its infrastructure to carry out operations such as loading and unloading cargo, replenishing their provisions, and changing crew. Port service providers, meanwhile, provide services to the port users. These services can range from agents providing administrative support in terms of booking berths for vessels to stevedores providing operational support in booking mobile cranes for loading and unloading cargo. The roles of each of the central actors and their relationship with port of Esbjerg departments are outlined below in further detail.

- Ship Captain

The chief function of the ship captain is to transport cargo to various ports, at which point it is loaded or unloaded before being transported on the rest of its journey by barge, train, or truck. The ship captain represents the carrier, and owns the key information of the master manifest – all the detailed information about the cargo on the vessel, the navigation plan to the port, the cargo stowage plan, and the arrival and departure plan for each port. With regards to the Port of Esbjerg, the ship captain is the central actor of the network, and communicates frequently with agents to share cargo information, vessel details, and the estimated time of arrival and departure. The ship captain also communicates to the port control department when they are navigating towards the berth, when they require a pilot, when they need a berth shift, and when they are requesting departure.

- Agents

The agent's function is to act as a representative for port users such as the shipper or ship captain. The agent owns most of the key information of any port operation, for example the estimated time of arrival/departure, the bill of lading and the cargo information. With respect to the Port of Esbjerg, agents are a central actor of the network, and communicate frequently with other agents, stevedores, ship captains and shippers to share details such as the estimated time of arrival/departure, crane type, cargo type, bill of lading and modality information. The agents also communicate to the port control and sales department when requesting berths, requesting cranes, and when requesting waste pick up or clean-up of the quayside.

- Stevedores

The stevedore's function is to perform all the operational administrative activities with regards to the loading and unloading of the cargo. Stevedores hold the key information relating to the cargo operation which needs to be carried out for the vessel. They own the information related to the cargo type and weight, which is needed to ascertain the crane type needed. With respect to the Port of Esbjerg, stevedores are a central actor in the network, and communicate frequently with other agents, stevedores, linemen, pilots, ship captains and shippers to share information such as the estimated start and finish time of loading/unloading, crane type, cargo type and weight. The stevedores also communicate with the port control, and technical department when requesting cranes or a clean-up of the quayside.

- Pilots

The pilot's function is to navigate the vessel into the port's basin and perform the berthing procedure. Holding a monopoly, the pilots are one of the non-central actors that play an important role in the Port of Esbjerg. In the Port of Esbjerg, pilots are a non-central actor in the network, and communicate frequently with ship captains regarding the navigation and berthing procedures but only sparingly with agents for the payment of invoices. The pilots also communicate to port control when there are emergencies.

- Linemen

The linemen's function is to perform the mooring of the vessel once it has berthed on quayside. Linemen are one of the non-central actors that have operational role in the Port of Esbjerg. In the Port of Esbjerg, linemen are a non-central actor in the network which communicate frequently with agents concerning the estimated time of arrival, berth number and type of vessel. They also communicate with agents regarding the payment of invoices. The pilots also communicate to port control when there are emergencies.

7.3. RESPOSBILITY OF THE PORT OF ESBJERG

The Port of Esbjerg is described as a service-oriented port which provides specific services including the mega infrastructure utilised by ship captains, agents, stevedores, pilots, train operators, trucks, and linemen. The role of the port is to maintain this infrastructure at its optimal level, as well as giving access to all the central actors to perform their jobs and operations. This section explains the various services offered by the Port of Esbjerg to its port community.

- Port controls’ port call optimisation is a notification procedure where the vessel must request berthing permission to the port control. This notification is done by the shipper and the agent representative of the ship captain. This procedure includes the vessel berth allocation process, cargo loading and unloading operation, waste disposal, slap oil pickup, crew change, and provision for vessel crew and equipment maintenance. The port performance indicator that measures this procedure generally falls under the indicator of share of correct handled ship services (percentage) (arrivals/departures/in port).
- Mobile crane rentals are where the stevedore can rent the mobile crane for carrying out the loading and the unloading of the offshore or project cargo on the vessel. The port performance indicator that measures this procedure generally falls under the indicators of container lifts per hour (per crane); use of manpower (hours) per handled tonnes /the number of cargo containers; damage costs per TEU; the number of damages per operation, or per day/month (new cars, containers, rolling stock); the number of work interruptions caused by equipment.
- Land rental / warehouse rentals are plots of land that can be rented to store cargo, build offices, or build shipyards to scrap vessels, amongst other things. The port performance indicator that measures rental profit generally falls under the indicator of late incoming payments from customers and late paid invoices.

Section 7.4. and 7.5. describes the varying perspectives of different actors as to what they think are the responsibilities of ports authorities regarding network boundaries, and what are considered to be the most essential port performance indicators.

7.4. SCOPE OF DIGITALISATION

The Port of Esbjerg management are pioneers amongst the Danish ports. Their strategy and vison is more entrepreneurial and innovative in comparison to their fellow medium-sized sister ports in the vicinity. The most recent opportunity recognised by the management was that there was going to be an increase in the market for offshore installation vessels and offshore wind power companies. As such, they began to investigate how they could incorporate digital platforms in order to improve their port performance.

In 2017, the Port of Esbjerg became more conscious of the opportunity to create greater value for the customer by investing in digital platforms. As a medium-sized port with a limited investment capacity, they realised that a single platform which could perform all these functions, that is providing information transparency to their whole network, would be more beneficial than a cluster of different platforms. First, using the lens of ‘port performance indicators’ literature, the “indicator” that this study aims to improve though data transparency is highlighted. Second, this case study aims to increase the volume of information flow in that indicator via increased density throughout the network, thereby creating greater efficiency.

7.5. THE ROLE OF PORT AUTHORITIES IN DIGITALISATION

The aim of this case study is to identify which port performance indicator requires a denser network. Rather than specifying a high-level strategic alliance, the relationship is built between two operational central actors. The task of defining the network starts with identifying the different links and relationships that are present within a business process established in the port performance indicator. One of the main interests of this paper is to establish the extent of the network density in a specific business process, and to recognise the central actors. In the interviews, port call procedure was frequently mentioned by central actors as an indicator which needed to be measured. As shown in the interview fragment below, the majority of work done by the Port of Esbjerg was described as "quay occupancy", "berth allocation" and "ship dues".

> "Our core business is … Ships dues and cargo dues, use, cranes, and all services. Our business is developing to offshore wind. That's the wind business. That's important for us."
>
> *The Chief Finance Officer of Port of Esbjerg, responsible for the port performance indicators and investment plan for the 'one decision one platform' digitalisation project, structured interview, 16th June 2017.*

> "Yeah, I agree that ports should be more in operation, but again you will see that the role of the port is purely infrastructural, so getting into the operation and doing systems for freight control and booking of, that would be the role of the terminal operator, that would not be the port. The port's role is more making sure the berths are occupied and ship dues are paid".
>
> *Chief Commercial Officer of Port of Esbjerg, responsible for new project cargo, vessel jack up and quay side sales, structured interview, 30th June 2017.*

> "You need to listen to your customers and you also, to some extent, adjust your strategy to what you hear, but I think you have to realise that ports have long term investments. They're heavy in assets, they don't have much flexibility in changing their direction because building new quays and areas, and the water depth, and so on. It's not so easy to change it. Hence once invested you need to focus on optimal return on investment on the assets. Mainly renting both our land and quay occupation"
>
> *Chief executive officer of Port of Esbjerg, Corporate strategy, structured interview, 22nd February 2017.*

The three key phrases of "quay occupancy", "berth allocation" and "ship dues" mentioned by the top management of the Port of Esbjerg were also reflected by other interviewees. According to the Danish Port Association, "ports are investing in new quays or in new land or in new moves and they are dredging out the port basin". On the other hand, the central actors' representatives, the Freight Forwarders Association and the Danish Maritime Authority, both emphasised that ports should focus on "providing basic functions such as quay side services of land and berthing". In contrast, the port performance literature shows that indicators based on intra-port operations and hinterland operations play an important role in the overall strategic efficiency of the network and can create the most value for the port authority (Tongzon and Ganesalingam, 1994; Brooks and Pallis, 2008; Song and Panayides, 2008). However, it is argued that to achieve efficiency in the indicators based on intra-port operations and hinterland operations, the performance carried out beforehand needs to be optimised.

Given this, the focus on port call procedure takes precedence over intra-port operations and hinterland operations. Nevertheless, central actors which participate in intra-port operations have greater access to external assets such as management skills from other connected actors, and information sources via a range of links. Accordingly, in comparison to other less central actors, they receive information sooner, meaning that they need to be involved into the port call optimisation. In theory, this is advantageous for the end-business central actor in the network, known as the 'shipper'. The shipper is better informed as to what is going on with the other actors per all three efficiency indicators, namely port call optimisation, intra-port operation and terminal-hinterland connectivity. However, this is not always the case, especially in the network of the Port of Esbjerg. The central actors in this case study are primarily agents and stevedores. They have power status due to their understanding of the three efficiency indicators described above. When interviewed about the port call procedure, they were asked to explain its business processes. One of the port control employees reported that that they do not receive information from the agent of the vessel for berth shift. Instead, it is the vessel that informs them on the day of the requested shift, which creates inefficiency in berth allocation planning.

> "They (vessels) won't be able to move from one quay to another if they don't tell us three days in advance. We get the request from the vessel to shift and then we contact the agents if they want to shift"
>
> *Assistant harbour master of Port of Esbjerg, Berth allocation planning, control centre visit, 2018.*

However, the port control of Port of Esbjerg did clarify that not all agents are reactive in their interaction. Despite their superior status, the majority do collaborate in sharing information. As we seek to identify the indicators which create administrative burden inefficiency, this raises the question as to which central actors in the port call procedure increase the administrative burden. These insights are triangulated with other port authorities with, for example, the Port of Aarhus and the Port of Alborg having been asked to share their understanding regarding port performance indicators. It became apparent that the Port of Aarhus, being a central actor in their own network, had divided their indicators with respect to capacity and productivity. Although the Port of Aarhus had achieved a higher network density, it remains similar to the Port of Esbjerg in terms of the actors and resources within the network. This provides us with insights into how a denser network contributes to particular indicators of port performance. For them, the productivity indicator is calculated based on the shortest wait time for the vessel. In the interview fragment below, the Port of Aarhus argues that indicators should contribute to productivity and capacity, and should give insights into which area(s) should be focused on in order to achieve productivity. Since they own their own cranes, and the whole network shares information, the following calculation can be used:

(1) Port controls' port call optimisation;
Share of correctly-handled ship services (percentage) (arrivals/departures/in port).

(2) Intra-port operation with mobile cranes;
Container lifts per hour (per crane);
Use of manpower (hours) per handled tones/number of cargo containers;
Damage costs per TEU;
Number of damages per operation or per day/month (new cars, containers, rolling stock);
Number of work interruptions caused by equipment.

As established previously, the Port of Esbjerg exists in a less dense network. In this network, agents receive information before those with accepted access to the arrival and departure information of a vessel. This set of information is generally not shared with less central actors, meaning that it cannot be described as efficient.

Both the Port of Aarhus and the Port of Esbjerg own their own cranes, which are booked by stevedores carrying out their operations, as discussed below:

> "When it comes to containers, we own the cranes, but the terminal operator provides the crane driver. That would be still, it's not our own goal but we're very focused on that productivity as well because that's a mutual interest for both us and the operator because our container clients are very keen on having a high productivity in order to stay as short as possible in the port. So, we focus on productivity in quayside operation."
>
> *CCO of Port of Aarhus, responsible for sales and customer satisfaction, structured interview, 16th June 2017.*

Similarly, the Port of Aalborg commented that that selected indicator should be related to improving customers' business, which is also echoed by the shipbroker' association and the transport company.

> "We have outgrown our area, so now we focus on taking the role of the architecture and improving our customers' business"
>
> *Director of Port Development of Port of Aalborg, responsible for growing customer business, 6th March 2017.*
>
> "In connection with the planning of operations, there are many things to do by the port administration and agents' operations. Ports facilitate the infrastructure and some of the superstructure and we pay the ship due and cargo dues. This should be realised by ports"
>
> *Director of Danish Shipbrokers Association, responsible for representing the agents' interests, 11th June 2017.*

"It's very difficult to 100% identify what roles or indicators the harbours would be because one day they wear this hat, the next day they wear this hat, and they are also - how should I put it - caught in some kind of vacuum in terms of how could they land on their own feet basically? Because they want to increase revenue, they want to increase traffics in the ports, for each individual harbour. The main challenge from my point of view, is that how can they attract new business and still keep us on the side-line."

CCO of Shipping DK, responsible for offshore companies' interest, structured interview, 5th September 2017.

This case study analysis thus seems to suggest that contributions should be made to productivity. In this case the most productive indicators were berth allocation and crane allocations, which present the opportunity to optimise and increase efficiency. However, from the data collected, it appears that the Port of Esbjerg has a less dense network compared to the Port of Aarhus. In case of the Port of Aarhus, it can be easily deduced that they are in a high-density network. This provides us with the motivation to further investigate whether the Port of Esbjerg can reflect the same kind of increase in network density. As such, the relevant indicators for the Port of Esbjerg are selected, which could be used for future investigation into the network centrality of the following, illustrating the links between a range of sources which share information in order to perform the following functions efficiently. We suggest the following two services.

1) Berth allocation contributes to the port performance indicator of port controls' port call optimisation. To increase efficiency in port performance of berth allocation, we need to improve our correctly-handled ship services;
2) Crane allocation contributes to intra-port operation where the efficiency port performance indicator is calculated based on project cargo lifts per hour (per crane), the number of work interruptions caused by equipment, and so on.

Considering the perspectives of central and non-central actors, it is realised that there are many indicators that create value to customers but still exist within the parameters of services provided by port authorities. Per Brooks and Cullinane, 2006, we limit ourselves to the port service which port authorities are responsible for in order to perform efficiently under the Danish port act regulations.

Section 8 and Section 9 present the indicators chosen and highlight different actors' contributions in the business processes with regards to the indicators, the perspectives of indirect stakeholders in terms of their expectations of the business process, and how other secondary actors support the business process.

8. ANALYSIS PART TWO :CASE STUDY AND ACTION RESEARCH

In mid-2017, the CEO of the Port of 'Esbjerg' asked me to work with them to implement my expertise on an assignment regarding their digitalisation ambitions. The objective which they focused on was building a digitalisation strategic plan which would contribute to the port's efficiency in the areas of daily commercial administration, data governance and customer service. Per the case study discussed above, we had previous experience of this kind of in-depth study in resource sharing in the inter-organisational networks of a port authority.This provided this paper with the scope for a more in-depth analysis. We accepted the assignment because it fits with this paper's research design aspiration of including both action research and design science as a part of analysis. This paper argues that in-depth longitudinal analysis would make the research more effective, and that the digitalisation strategy could create a denser network, leading to a recommendation of new port governance (e.g. a port community system). It might also help answer the question as to how information availability contributes to efficiency in port performance. Since previous research on digitalisation has eschewed application-level business cases, this paper focuses on how applications or platforms developed within the limits of traditional port authority's structural embeddedness could contribute to the current port performance literature.

The second part of the analysis starts with the intention to highlight the 'network' in the port networks relationship towards information availability, and how this contributes to efficiency indicators in port performance. This part of the analysis uses a combination of a case study and action research to illustrate the relationships within the network in the context of allocation berths and allocating mobile cranes. To illustrate this, we follow the structural embeddedness of procedures, where we highlight the position of each network central and non-central actor recognised previously in part one of this analysis. Furthermore, this illustration will highlight the argument that this port authority has to increase their centrality through frequent access to information from the network. This will ultimately increase the density of the network, which potentially enables us to increase the efficiency port performance measurement. To illustrate the structural embeddedness of our network, we initially justify the need to study the existence of structural embeddedness in port performance. We further define the elements of centrality, structural autonomy, and structural equivalence that will be adopted as lenses to illustrate the density of the network which exists in the Port of Esbjerg. Secondly, we argue that density as a network property affects the performance of the whole port network. We present three hypotheses to investigate our assumption in greater depth. Thirdly, we conclude the previous part of our analysis by illustrating the network density of the network that is present in the business process of berth allocation by port control and crane allocation by port control. This illustration highlights the structural embeddedness relationship among central and non-central actors, providing us with insights into the network density of network and supporting us in our attempts to validate our hypothesis.

8.1. TERMS DEFINED IN THE PORT CONTEXT

8.1.1 STRUCTURAL EMBEDDEDNESS

Structural embeddedness describes the general design of the network through the stream of information that links different organisations together for a particular purpose. Furthermore, it highlights the informative role position of each organisation in the whole structure of the network (Gulati, 1998). The roles are highlighted as descripted nodes that are connected to each other in the network (Granovetter, 1985). In general terms, scholars conceptualise structural embeddedness in a similar way to rational embeddedness (Gulati, 1998; Rowley *et al.*, 2000). Some scholars argue that structural embeddedness is more reliable than rational embeddedness because its attributes better describe the strength of the relationship ties than rational embeddedness (Granovetter, 1985; Gulati, 1998; Long and Chen, 2021; Rowley *et al.*, 2000) However, the literature remains elusive in providing a 'defined' definition of structural embeddedness (Field 1997), with the majority of the research focusing on conceptualising structural embeddedness rather than defining it. Structural embeddedness can be used to understand the strength or weakness of an organisation's information position in its network (Rowley *et al.*, 2000). It translates relationships within an organisation, the frequency of communication and importance of the information shared into the position of importance it holds in the network and the impact it can create through its existence (Gulati and Gargiulo, 1999)). Therefore, this paper argues that to improve structural embeddedness, it is essential to illustrate the behaviour of information sharing between different organisations, the competitive power they hold in the network with their information, and the advantage they have vis a vis selectivity sharing this information. With respect to port networks, structural embeddedness highlights the position of the port authority and how it connects to a range of actors who either use the port infrastructure or port series on the infrastructure. Therefore, creating complex links between various actors who share information can optimise an activity or operation. The structural existence or absence of organisational links - in our case port actor links - demonstrates a key point about what can be improved.

Previous research has adopted indicators in order to conceptualise structural embeddedness. The focus has been more on 'configuration driven indicators' which illustrate the architecture of the network and highlight different levels (firm level, pair level and network level) of connectivity of the network (Bliemel, 2010; Ghosh *et al.*, 2016; Gnyawali and Madhavan, 2001; Granovetter, 1992; Long and Chen, 2021; Moran, 2005)). The result has been the greater understanding of a more in-depth, information dense network. Conversely, other researchers (Gulati and Gargiulo, 1999; Iurkov and Benito, 2017; Rowley *et al.*, 2000)have described position-driven indicators that isolate their study only to positional attributes of structural embeddedness (Long and Chen, 2021).

Indicators provided by Gnyawali and Madhavan (2001) have been selected to illustrate the architecture of information sharing by different port actors and their connectivity with the port authority. These indicators describe the structural embeddedness in this port network, and include centrality, structural autonomy, structural equivalence, and network density. Network density tends to focus on the impact that structural embeddedness has on the network density, and on the impact which the network has on the performance of the organisation's activities (Gonzalez *et al.*, 2014). This encourages the organisation to focus more on strengthening their network so as to gain a stronger strategic position. In this particular case, this is ensured by learning which information is the most essential and "non-redundant" for maintaining their strategic position (Yang *et al.*, 2011), thereby enabling the port authority to understand where to build a collaborative digitalisation project to increase network density.

8.1.2. DEFINING CENTRALITY IN PORT CONTEXT

Network centrality refers to the position of a single actor in the network concerning the extent to which the actor captures their strategic position within the network by being involved in significant links (Gnyawali and Madhavan, 2001; Wasserman and Faust, 1994). In the specific context of this paper, it can be argued that, firstly, the higher the centrality with different information sharing actors, the stronger the strategic position. This leads to a greater flow of assets, information, and expertise throughout the network (Galaskiewicz, 1979, 2011). In the context of port performance, an indicator such as 'decrease lead time for vessel berthing' depends a lot on the correct ETA being submitted by the agent along with other ship-related information. Missing even one piece of important information can result in a high lead time for vessel wait. This generally happens due to a lack of technology for presenting the correct information, errors in transferring similar information repeatedly to different actors, or the time-consuming manual input of information that can only be done during working hours. Therefore, central actors (agents, per the example above) are important because of their access to relevant information, management decisions and mandates from other connected actors.

Secondly, central actors with denser ties have access to information earlier in comparison to less central actors (Rogers, 1964). In the context of port performance, indicators such a 'delay in loading and unloading cargo operation at the quayside' can be avoided when port authorities receive the ETAs of vessels, truck operators and terminal operators as early as possible from the agent, who in theory receive updated information far earlier from a range of sources (Gnyawali and Madhavan, 2001; Valente, 2003). Thirdly, the higher the centrality, the higher the power and importance (Wasserman and Faust, 1994) because an actor who has accessibility to a range of sources should be considered as holding a major role in the network. It therefore follows that central actors who have access to resources and opportunities that create real value to the network should be recognised and considered by other actors (Gulati *et al.*, 2000). In the context of port networks, agents are more central actors than port authorities because of their ties to different sources. They are connected to the vessels that call ports as well as to the stevedores who will load and unload cargo at the quayside; they are also in continuous contact with port control. This means that the participation of the agent can also increase the participation of other less central actors.

8.1.3. DEFINING STRUCTURAL AUTONOMY IN PORT CONTEXT

Structural Autonomy refers to a situation where actors do not experience structural holes themselves but do experience them with their connected partners (Gnyawali and Madhavan, 2001) . Their role is that of a 'middleman', having access to key information and controlling when and with whom they can share this information. This means that structurally autonomous actors can create an environment for high-quality information within the network which is unique and holds a lot of value. In the port context, agents, stevedores and terminals are structurally autonomous since they have access to information such as ETAs, customs inspections, stowage plans, cargo types and terminal gate in / gate out information. All this information is highly sought after for shippers, port control, stevedores, linemen and pilots. Agents with non-existing structural holes can interact and connect to a range of port actors. They have higher bargaining power compared to their network partner port control. In the context of berth allocation and crane allocation, this provides an opportunity for port control to strengthen their connection with agents so that they have access to information that can create value.

In addition, recognising structurally autonomous actors can provide port control with insights into the type of actors with whom they should strengthen their relationships. On the other hand, autonomous actors such as agents and stevedores have significant control over the key information which can produce a low-density network for port delivered service. Taking this into consideration, we argue that its essential for port control to create high density in the network and low structural holes for port control.

8.1.4. DEFINING STRUCTURAL EQUIVALENCE IN THE PORT CONTEXT

The concept of structural equivalence states that two actors are exactly structurally equivalent when they have similar relationship ties with another individual. Some actors have a higher degree of similarity when they are placed in approximately the same position in the structure (Burt, 2000; Gnyawali and Madhavan, 2001; Long and Chen, 2021; Lorrain and White, 1971; Rowley *et al.*, 2000)). This means they face the same sort of limitations, advantages, and opportunities. In the context of a port network, structural equivalence has been used to capture structural similarity in the agent's and stevedore's actors. It is understood that when two structurally equivalent actors connect closely, the result is generally similar information, behaviours, and interaction (Gnyawali and Madhavan, 2001; Long and Chen, 2021; Rowley *et al.*, 2000). In respect to berth and crane allocation, both agents and ship captains tends to imitate each other with regards to information such as ETA, ETD and vessel information. When compared to these two services, they have high degree of similarity in behaviour, access to information and linkage with other actors (e.g. stevedores and port control). Creating a similar information cluster between them can inspire cooperation, thereby creating value out of the overlapping knowledge. For the port authority, this creates the opportunity of having two sources of information which they can access for optimising berth and crane allocations. Similarly, with the understanding that structurally equivalent actors can also lead to innovation and information integration, we argue that the port authority should focus on creating an environment that creates higher structural equivalence between themselves and agents with regards to optimising port services. With regards to agents and stevedores, although they both have similar access to information, similar interaction with customers and a high degree of similarity in behaviour, they are not high in structural equivalence because of their low interactions.

8.1.5. DEFINING NETWORK DENSITY IN THE PORT CONTEXT

A higher network is a governance mechanism for a highly interconnected network - a network which continuously shares relationship and routines (Rowley *et al.*, 2000). It signifies that the interconnection has developed a practice of intensive conversations, shared routines, and dependability from multiple sources. For instance, over a period of time, most vessels use the same agent and call the same port. This means that the same sources share information and create a routine within the network; however, this network is disrupted if one of the sources does not contribute the same information as it has done previously. This can result in problems for vessels, for example increased waiting times due to mistakes in pre-notification procedures, longer lead times in vessel journeys, or delays in cargo loading and unloading. All these inefficiencies have been studied in the literature from the perspective of quantitative efficiency. Increasing participation in the network also makes the network centrality denser. Network centrality is one the structural embeddedness variables which is explained by centrality degree, closeness, betweenness and density (Borgatti, 2005a; Borgatti and Li, 2009). This paper develops its proposition on network centrality (Borgatti, 2005b; Gnyawali and Madhavan, 2001), which is one of the delineated variables of structural embeddedness. It focuses on the question of how to create value through denser networks, with the likelihood of efficiency in port performance indicators. In particular, the research begins by questioning how network centrality contributes to indicators which are related to greater efficiency, and which increase network density.

Hypothesis:

Proposition 1: All else being equal, as the centrality of (agents) actors increases, (a) the likelihood of the administrative process and burden of the port authority decreases, and (b) the likelihood of other actors' collaboration increases.

It can be predicted that the increase in participation flow between different central actors influences better port performance. Firstly, an increase in access to assets due to the participation of competitive actors provides versatile assets and intensive knowledge, which leads to the central actor capturing more value. In the context of port performance, if the agents initiate a routine of sharing information with port control, this will also encourage vessel captains to update port control about the journey of their vessels (e.g. ETA) or the need for other services (e.g. waste pick up) much earlier than before. This gives port control more space to plan their berth allocation for each vessel and to schedule their waste pick up plan so that vessels do not prolong their visit unnecessarily. The result of this would be a decrease in the port's 'number of delays in vessel services.

Secondly, an increase in participation provides the central actor with the knowledge about other actor's strategies and ambitions, thereby giving them the opportunity to create long-term value and to improve some of the redundancies which they themselves have created due to the lack of insights about other actors. In the context of port performance, customer satisfaction can be achieved through a decrease in 'number of damages per operation or per day/month (new cars, containers, rolling stock)' and 'number of work interruptions caused by equipment'. In the long run, customer ambition and vision benefit the port investment plan for infrastructure and technologies. Thirdly, power status which is achieved due to centrality also gives the actor the power of being the first in the initiative, and therefore receives less push back compared to others (Gnyawali and Madhavan, 2001). In the port performance context, agents tend to be the more central actor and have the superior status because of their accessibility. This gives them the status to start a conversation in the network regarding collaboration and participation from other central actors such as vessels and terminals. Consolidating the above arguments about central actors' likelihood towards participating and collaborating towards port performance indicator, this paper proposes the following:

Proposition 2: All else being equal, as the involvement of two or more of higher centrality actors in a network increases, (a) the likelihood of competitors' collaborating together increases, and (b) the likelihood of competitors initiating a response or a participation to an action increase.

This paper follows (Gnyawali and Madhavan, 2001) in accepting that network density plays a guiding influence on the relationship proposed in hypotheses (1) and (2). They argue that an increase in network density will decrease the effects of centrality (Gnyawali and Madhavan, 2001). For this paper, the focus is more on creating value through greater participation and collaboration for sharing resources. Although one potential outcome might be a decrease in centrality, this paper aims to increase the volume of information flow through increased density throughout the network to achieve efficiency. Subsequently, central actors are recognised and encouraged to contribute to the density of the network through participation and collaboration. In the port context, the central actor for the port authority are agents that have ties to various sources, meaning that they have the opportunity to create impact within the network with a higher velocity of information flow.

Proposition 3: All things being equal, an increase in network density (1) will create a positive increase in the bargaining power of competitors, and (2) will create a positive relationship in the whole network regrading value creation.

Another important factor is that density will enable information to flow to more autonomous actors that interconnect to the network through indirect connections. In the port context, these are operators such as tugs or linemen who receive information from port control rather than directly from agents. Overall, a decrease in the advantages which a central actor has will lead to greater bargaining power amongst other actors, who can collaborate and allow less advantageous actors to respond. In the port context, agents with high market share tend to have more influence about the information flow chosen for standardisation within the network, so as to either decrease the administrative burden or to atomise the processes. In contrast, other competitors who provide only one service do not have the bargaining power to negotiate the network focus. Consolidating these arguments, it can be seen that an increase in density can diminish the centrality of actors, thereby creating the likelihood that other actors will have greater bargaining power.

The section (9) below demonstrates the dominant research methods and explains how they can be used in validating propositions 1, 2 and 3. **All three propositions will be tested in section (9) below, through the methodological lenses of case study, action research and then in section (11) of part three of the analysis using design research.**

9. ILLUSTRATION OF LOW NETWORK DENSITY

Network density can be recognised by illustrating the centrality of each actor in the network. To achieve structural embeddedness, all the present network centrality should be dense within the network. In this paper, we argue that port control has decreased network centrality in comparison to other actors in the network. This disparity results in low density within the network. As outlined in the analysis in part one, port control is responsible for providing both berth allocation and mobile crane allocation to the other central actors. There is a need for a high-density network that could build a continuous flow of information to achieve optimal performance.

Network centrality is recognised by first highlighting the position of specific actors in the business process of both berth/crane allocation, and how this supports other links in order to achieve successful vessel berthing and discharging of its cargo operation. As stated above, berth allocation is a part of the business process by which agents request specific berths situated in the Port of Esbjerg. Similarly, crane allocation is a part of the business process by which stevedores book cranes owned by the Port of Esbjerg in order to arrange loading, stowage, lashing and securing of cargo onboard the vessels. Crane booking is considered an intra-port operation, and specifically contributes to project cargo lifts per hour (per crane) and the number of work interruptions caused by equipment. Essential information flow is provided by the central actor agents and stevedores, and the assets are provided by the port's control and technical department. There are various scenarios described in the case study concerning the selected indicators of both berth and crane allocation procedures and invoicing.

Guided by action research and the case study method, the business processes of berth allocation and crane allocation are described. The aim is to illustrate the various ways in which key information is shared between central actors and to illustrate the density of the network. Through this, the position of the port authority in the structural embeddedness of the network can be understood. This insight will be further tested to validate propositions 1, 2 and 3.

The illustration using action research provides the visualisation of the information flow between central and non-central actors. For this illustration of density in the network, port control was observed in its natural environment, and interviewed as it went about its day-to-day basis. These observations were carried out in the port control and technical departments, for the purpose of mapping out the flow of the business processes of both berth allocation and crane allocation. Moreover, other actors in the community who requested particular services from the Port of Esbjerg were also interviewed. This demonstrates that the governance mechanism which exists amongst port users and port service providers with regards to information sharing for the two operations.

The network density of berth and crane allocation are illustrated separately. We follow the pattern of the movement of the port control and technical departments in allocating berths to vessels and allocating mobiles cranes to different stevedores. We break down the communication pattern in 'links' where two port actors share key information to start the allocation planning and execution. Each LINK provides us with information regarding its level of centrality as well as its importance in the overall network density.

- Information Flow

  The arrow marks the direction of the key information flow. We argue that the person who is owns the information has the greatest centrality in the network because they hold the key information without which the port control cannot perform the necessary steps. The owner is defined as the actor who has the right to share the data with other actors without requiring any permission. When the information is shared, the right still remains with the owner, who can limit the use of data for the receiving actor.

- High centrality actor

  Actors who hold a high level of centrality are marked with a circular node. The bigger the node, the higher the centrality of the actor.

- Low centrality actor

  The actors that hold a low level of centrality are marked with a circular node and are comparatively smaller than the nodes for higher centrality actors.

9.1. BERTH ALLOCATION

Berth allocation is described as a procedure for allocating a specific berth location to a vessel on a specific day at a specific time so that its cargo can be loaded or unloaded, and so that the crew can be changed. Berth allocation is a part of the port call optimisation service of the port authority. The main actors in the berth allocation process are agents, the vessel captain, stevedores, and port control. There are various scenarios in the case study which discuss the indicators for berth allocation.

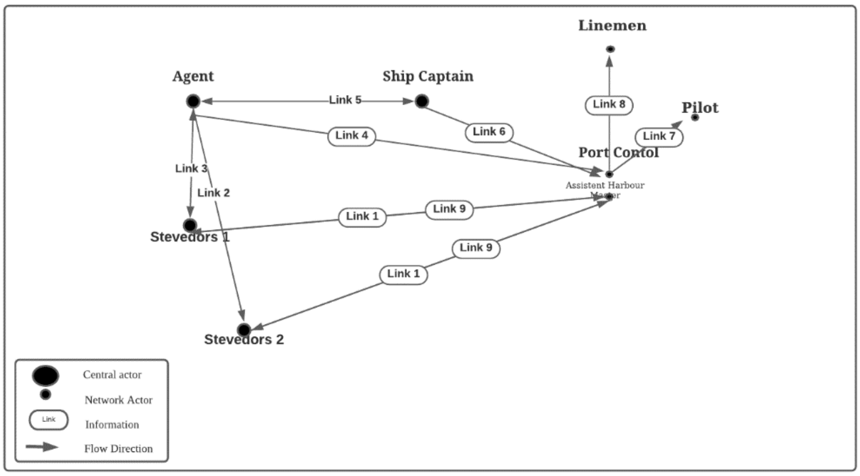


Figure 18: Illustration of Current Network Centrality and Density of Berth Allocation

- **STEVEDORES 1&2 TO PORT CONTROL (LINK 1 OF FIGURE 18)**

Link 1 recognises two stevedores as central actors because of their accessibility to knowledge and their capabilities in performing the loading and unloading of cargo services. They receive requests of order from the shipper anywhere between three months and three weeks before the agents are hired, or a vessel is chartered to call the port. Most of the time, the order consists of information about the size, type and frequency of the cargo arriving to the port. Both Bluewater Shipping (BWS) and Jutlandia provide stevedore services of loading, stowage, lashing and securing of cargo on board the vessels, as well as supervising discharge operations. The study interviewed various foreman in group meetings from both the BWS and Jutlandia terminals. BWS consists of experienced foremen who had previously worked as sea captains and chief officers offshore, whereas Jutlandia is a much smaller company which focuses on cargo-specific solutions. Generally speaking, both are the first actors in the network to receive information about what kind of cargo will arrive in port. They use this knowledge to plan their schedule between various assignments. However, it is also an isolated practice in their own company.

> "We receive information three weeks before, but we don't know on which vessel will it arrive."
>
> *Operation Manager Port Agency at BWS, responsible for planning stevedoring project cargo.*
>
> "Yes, we do get contacted about our stevedore information before we know which vessel it is going to be on. Mostly it's the same vessel as before so it's not a problem for us"
>
> *Business Support and Sales Manager at Jutlandia Terminal A/S*

Although this information is not shared with the freight forwarding department of their company, this information is shared with the assistant harbour master when enquiring about the possibility of berthing, and whether there is any possibility of executing the assignment. This information is initiated with the assistant harbour master, but is not recorded.

- **AGENT TO STEVEDORES 1&2 (LINK 2 OF FIGURE 18)**

Links 2 & 3 highlight the agent as a central actor. Agents are the representatives of the shipper, and hold considerable power in the network. Freight forwarding companies provide multiple solutions to the shipper, guiding them through the whole shipping processes. The shipping processes are very bureaucratic, involving various parties who work and provide information to each other. All of this is organised by freight forwarders.

> "We represent the shipper, we do any kind of transport. That would be shipping, stevedoring, custom clearance, cruises, logistics. So, every part of transport and logistics within that segment that is called shipping DK. Represented in approximately 14 harbours here in Denmark as well as in Sweden also, doing all this clearance, stevedoring, et cetera, so basically it comes down to every aspect of forwarding."
>
> *Chief Commercial Officer, Shipping DK*

- **AGENT TO STEVEDORES 1 & 2 (LINKS 2 & 3 OF FIGURE 18)**

Links 2 and 3 highlight the information (ETA, bill of lading from the shipper, manifest from the vessel and vessel registry, and crew provision list), capabilities (planning the assignment, contacting the transport for hinterland connectivity) and assets (technical assets such as AutoCAD, or operation assets such as self-propelled modular transporter (SPMT) which is shared between agents and stevedores. These are two of the most important central actors in the network, and they achieve network centrality between themselves.

- **AGENT TO PORT CONTROL (LINK 4 OF FIGURE 18)**

Link 4 highlights the only information shared between port control and the agent, who is the representative of the shipper and the actor responsible for constantly being in contact with the vessel, and updating the port with the ETA. The agents share the request to berth at the port and to carry out various operations between 24 and two hours prior to the vessel's arrival for berthing. This is one of the important links for the Port of Esbjerg to achieve improved efficiency in terms of port control's port call optimisation performance, where information about indicators for sharing correctly handled ship services (percentage) (arrivals/departures/in port) is owned by Freight Forwarders.

> "We have a very good system. The agents send us an email 24 hours before or sometimes we receive email two hours before for berth in the port. That is not a problem in the working days but in weekend the agents cannot reply or confirm to our email even though we are (port control) available 24 x7. So, then we need to call them (agents) and record it on logbook for the next assistant harbour master shift to continue the conversation."
>
> *Assistant harbour master, Port of Esbjerg*

If this information is provided at the right time to the port authority, they can plan berth allocation, decrease waiting time for the vessel and improve hinterland connectivity by decreasing the waiting time of truck operators when loading and unloading mega cargo in the berth. Most of all, the administrative burden of both the agents and the port authority can be decreased if information is shared and stored in an easily accessible platform. At present, the agent provides information about the vessel arrival via phone and emails. The updated ETA is shared via email and can be overlooked if there is any asymmetry with the changing of the assistant harbour master. Similarly, from the agent's side, if the updated information is not shared with port control because it is, for example, the weekend, and emails were not checked because they arrived outside office hours.

All the communication between Port Control and the majority of their agents is through phone and email. However, asymmetry arises when cargo type information is provided by stevedores three weeks before a vessel's arrival. This insight is not used by port control until an agent is allotted by the shipper. This information is received via telephone but is not recoded in any form. It is only remembered by two port control harbour assistants. This is understandable because agents, being central actors in the network, focus only on essential data. However, this does highlight an opportunity for port control to organise their stevedores' and agents' information in one digital place rather than manually in different recording sources. If this digital platform gets updated and is accessible to all the stevedores and agents through a safe login, they can control and manage the information, achieving information symmetry.

However, central actors are not so keen to share information with less central actors. This is because port network information is as valuable as physical assets, and can contribute to increased traffic of business for an agent. Agents compete for business through commission, and their value is knowledge, capability and information. Therefore, it is understandable why they do not want to decrease network centrality. This kind of understanding is cited accordingly by the Chief Commercial Officer of a Transport company:

> "I know it's in the common discussion that we're going to compete with disruption, with digitalisation, then we have the question of do we need a forwarding agent? Because that's the next question. I find it extremely interesting, and it scares me, on the other hand, but if you look at it, digitalisation called for instant deliver for example Amazon or Alibaba, it's a question that some have the capacity, others have the needs. What do you need in between? You can either choose a forwarding agent, or you can use a digital platform. So, we could be eliminated by the end of the day, but still, if you must make some conclusion and I guess we have, then the infrastructure within the ports is that basis for my point of view. Port is the service operator, ordered due to their way of ownership normally, to some extent, government, local, involvement. So, they should give us the infrastructure that they should serve us, but that is exactly where it stops."
>
> *Chief Commercial Officer, Shipping DK*

- **AGENTS TO SHIP CAPTAINS (LINK 5 OF FIGURE 18)**

Link 5 highlights the communication between agents and the vessel captain. This generally happens when the shipper hires an agent on their behalf to carry out all the communication, documentation and duties' procedures required by the International Commercial Terms (Incoterms) guidelines. This agent sometimes represents the vessel and receives the most updated and reliable information about the vessel status and current situation. This provides agents with the mandate to start the pre-arrival procedure of the vessel in the port, which includes the request for the berth location, pilot, linemen, and tugboat from the port control. This link is the densest, with constant information flow between both agent and vessel captain.

- **VESSEL CAPTAIN TO ASSISTANT HARBOUR MASTER (LINK 6 OF FIGURE 18)**

Link 6 highlights the communication between the assistant harbour master and vessel captain. The first communication happens through the VTS network, whereby port control is officially updated about the vessel's position and approach towards the quay. At that point, a request for a tug and pilot, if required, is made. This information is recorded in the Haven 2000 software, which is a customised version of Navision Software. The vessel captain continues to update port control as required through the VTS about any developments or changes.

> "The vessel calls us through the VTS control. If there is any question or request or if the vessel is turning off the communication, or there is a problem they need to update us. I write the notes and additional information in the logbook so that next assistant harbour master is updated but not everyone does that. If the problem is solved within one shift, then it's not recorded by that colleague."
>
> *Assistant harbour master, Port of Esbjerg.*

- **LINEMEN AND THE PORT CONTROL AND PILOT (LINKS 7 & 8 OF FIGURE 18)**

Link 7 and Link 8 highlight the conversation between linemen and the port control and pilot. All three are not central actors but play an important role in berth allocation. The sharing of information occurs when the vessel captain contacts port control with a request to navigate towards the allocated quay location. At that point, the tugboat and the pilot are requested by the vessel captain to navigate the currents and safely berth at the allocated quay. The assistant harbour master provides the number of the tugboat. Simultaneously, agents in Link 5 provide the linemen with the ETA of the vessel, the name of the vessel and the berth location. Similarly, in Link 9, the agent provides similar information concerning the ETA of the vessel, the name of the vessel and the berth location to the stevedores, so that they can supervise the discharge operations of loading, stowage, lashing and securing of cargo onboard the vessels. This continuous communication between various central actors and non-central actors in Links 5, 6, 7, 9 and 9 generates the information that initiates a vessel's berth allocation procedure. The Link 8 information flow is responsible for generating the actual time of arrival (ATA), i.e. when the linemen dock the vessel to the fenders.

PORT CONTROL AND STEVEDORES (LINK 9 OF FIGURE 18)

The Link 9 information flow overlooks the completion of the vessel discharge procedure, generating the actual time of departure (ATD). All this information is important for the efficiency of port performance and contributes to the port performance indicator of port call optimisation and for calculating ship dues.

9.2. CRANE ALLOCATION

Generally, for intra-port operations in the Port of Esbjerg, the port's technical department provides stevedores with mobile cranes for performing specific loading and unloading operations. To book a mobile crane, agents must provide information 24 hours prior to when it is required. Agents book the cranes via an email request with information about the vessel name, type of cargo and the relevant times. This information contributes to the efficiency of port control's berth planning, crane schedule, and ship and crane dues. Similarly, the mobile cranes provide stevedores with the assets to perform their operations on the quayside.

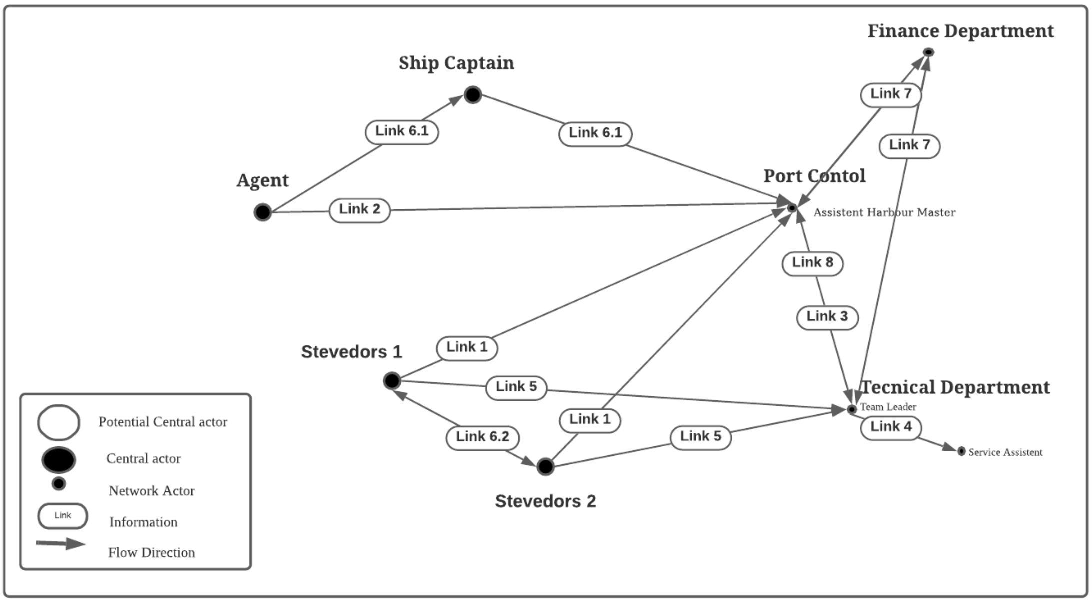


Figure 19:Current Network Centrality and Density of Crane Booking

- **STEVEDORES TO PORT CONTROL (LINK 1 OF FIGURE 19)**

Link 1 highlights the communication between central actor stevedores and less central actor port control which takes place 14 days before the agent starts the pre-arrival procedure for port arrival notification. In this communication, stevedores enquire about the possibility of carrying out the loading or unloading of certain cargo, and whether the port has the capability to handle such cargo. This enquiry gives port control insights into what kind of cargo will be arriving in the next few weeks, and provides information about improving their own planning of the 'cargo position' phase.

In planning the 'cargo position', the port control considers different scenarios based on certain limitations:

- Quay Capacity – whether the quay can hand handles the weight of the cargo;
- Quayside space – whether the quayside has enough space available to store to cargo and the mobile crane, and, if needed temporarily, the vessel crane, which would not hinder the movement of other nearby operations;
- Accessibility to the Hinterland – whether the quayside has good accessibility for SMPT trucks to navigate mega cargo towards landside (e.g., road); and
- Vessel Berthing – whether the allotted quay has the required draught for the vessel to berth.

> "BWS or Jutlandia call me and ask if the job is possible, and I ask them about the type of cargo and volume…It's just an enquiry so not stored in any software. It's just for my information. I store it in my brain."
>
> *Assistant harbour master, Port of Esbjerg*

This was confirmed by the transport service company, albeit with understandable justification that this was just an enquiry rather than a confirmed order.

> "Yes, we do get contact by shipper for jobs we contact the assistant harbour master to enquire if the port can handle the job, we enquire many ports for good price but for us it's important that its quick and we get priority…. No, we don't update about this to the sales department."
>
> *One of the stevedores in group meeting, BWS*

In Link 1, both BWS and Jutlandia stevedores provide information via phone and email 14 days prior to the agent's official pre-arrival (24 hours) and crane booking request (24 hours). Most of the time, this information is shared by phone and is not recorded anywhere, existing only in the memory of one assistant harbour master. The email consists of specific essential information about the cargo type and volume, which helps port control gain insights into the cargo planning – for example which quay would be best suited for those particular cargo operations and would not hinder any other operations taking place nearby. This planning, however, is not confirmed until the assistant harbour master receives specific vessel details, namely the ETA, ship name and ship size from the agents, and the mobile crane booking request. Given this, to improve the port performance indicators for intra-port operations, this kind of information is required at the planning stage. Moreover, a continuous sharing of such information from the relevant actors will decrease the interruptions which occur in operation planning and execution.

- **AGENT TO PORT CONTROL (LINK 2 OF FIGURE 19)**

Link 2 highlights the information held by agents, and the way in which they share key information. This information is shared 24 hours prior to the vessel arriving at port control. The agents hold essential information and capabilities including the ETA, the bill of lading from the shipper, the manifest from the vessel and vessel registry, and the crew provision list. They are the central actor, with whom nearly all the different actors must share information with. Because of this, they hold the latest and updated version of the information.

> "We always take agents ETA into consideration when planning the berth even if AIS or vessel finder gives us another ETA. We always follow agents' update."

Agents provide the updated ETA through emails. If it is the weekend, or there is an emergency, the agents call the port control with the relevant information. Simultaneously, the Port of Esbjerg's technical department provides a mobile crane for two of their stevedoring customers for loading, unloading, and securing cargo on vessels (mainly wind turbines) while the commercial department provides prospective and current customers with customised services for warehousing, long-term jacking up the vessel or plot rental for two of the world's largest offshore companies for preassembling, servicing, and storing of offshore wind power. For this, the agents send an email with a request to book the mobile crane. This email contains information such as the weight and volume of the cargo, the type of the mobile crane, and the hours when the mobile crane needs to be available. The assistant harbour masters check their email regularly in order to match crane bookings with berth requests. This process of crane booking contributes to port performance indicators and can be improved if the agents request the right type of mobile crane and if all the crane bookings are received at the right time so that the mobile cranes can be shared optimally between the two stevedores.

In so doing, two sets of challenges occur. First, mobile cranes are booked in time slots, and they may be needed in different locations across the 14km of quayside. When booking a slot, agents do not consider the transit time needed for the crane to reach them. Port control, however, realises that the time spent driving the mobile crane between these quays contributes to the inefficiency of mobile crane sharing. Second, agents lack the technical insight into which crane type is needed for a particular cargo operation, meaning that they tend to book the wrong mobile crane and the wrong location. To rectify this, the assistant harbour master checks the booking and contacts those agents who have booked the wrong crane to rebook the cranes and update the location where the crane is required. These inefficiencies contribute to increased interruptions between operations for the stevedores. In addition, it is also expensive for the port technical department to drive the mobile cranes around due fuel consumption as well as the capability and time lost when the crane is not actually carrying out operations.

- **BETWEEN THE TECHNICAL AND THE PORT CONTROL DEPARTMENT (LINK 3 OF FIGURE 19)**

Link 3 explains the business process between the technical and the port control department to confirm and to execute the order of the agent. 24 hours prior to the delivery of the mobile crane to the dedicated location, the assistant harbour master mails the list for the day to the service assistant. This list consists of all the locations where the mobile crane should be available. Sometimes, if a slot is booked by two agents, then priority is first come, first served. The stevedore is informed about the availability of the cranes, and booking is confirmed 0900 the day before.

- **TECHNICAL DEPARTMENTS TO STEVEDORES (LINKS 4 & 5 OF FIGURE 19)**

Link 4 shows the transfer or information and assets between a central actor and non-central actor. Once the mobile crane is booked, the mobile crane is driven by a service assistant to the location requested by the agent. The time of use, confirmation of delivery and any pertinent incidents are then registered by the driver and delivered to the team leader. The team leader confirms the details with both stevedores. However, Link 5 shows that there are cases where the team leader is contacted by stevedores with a request to move the crane to another location because the draught is higher, or because it is a challenge to carry out the operation alongside the vessel. In such circumstances, the stevedore suggests another location for carrying out the operation. This contributes to delays and interruptions in the crane operation, and has an overall negative effect on port performance.

- **BETWEEN AGENT, SHIP CAPTIAN AND PORT CONTROL (LINK 6.1 OF FIGURE 19)**

Link 6.1 shows the actions which the ship captain undertakes when the stevedore contacts the team leader, when the crane has to be moved to another location due to a change in draught. The ship captain requests a berth change, and the agent officially requests his via email, so that the berth allocation is updated. The ship captain also informs the VTS operator 30 minutes before the ship plans to shift berth.

- **BETWEEN STEVEDORES 1 & 2 (LINK 6.2 OF FIGURE 19)**

Link 6.2 shows an alternative action which may take place between two stevedores, when the planned crane operation cannot be undertaken due to the change in draught for the vessel. At this point the two stevedores discuss how they can solve the problem of crane sharing. This contributes to better scheduling of crane utilisation and decreases the operation instructions and delays in crane accessibility. However, during this stage of planning, only the team leader and the service assistant are informed. This is not registered until the final list of usage is collected by each stevedore and shared by the service assistant to their team leader.

- **BETWEEN PORT CONTROL, FINANCIAL AND TECHNICAL DEPARTMENT OF THE PORT OF ESBJERG (LINKS 7 & 8 OF FIGURE 19)**

Link 7 and Link 8 highlight the movement of essential information owned by central actors, but which is then shared to port control after execution for the purposes of invoicing. As stated in Link 4, at the end of the day the service assistant (driver) sends an email to their team leader with details of the final job executed, along with any pertinent changes. The team leader sends an email for confirmation to the two stevedores regarding the hours the crane was used. After confirmation is received from the two stevedores, the hours are submitted to the finance department in order to calculate the crane dues, ship dues and commodity dues. A copy of this invoice is then sent to the stevedore and agents, and a copy is stored as a receipt by the finance and port control department. At the end of each month, the assistant harbour master receives a paper list of the total dues of each ship for confirmation and final check.

10. INCREASE STRUCTURAL EMBEDDEDNESS OF THE PORT NETWORK

Following an in-depth investigation of administrative procedures and berth allocation planning, this study ascertains that there is various non-redundant information held by the top three types of port actor. This in-depth illustration also suggests that when these needs are shared through sporadic updates to the port authority, the administrative burden increases. To increase the structural embeddedness of the network, a continuous flow of information towards the port control, technical department, and financial department is required. This set of key information does not come directly from the primary actor, but rather from its representative. Agents, for example, are representatives of the vessel captains, and are legally responsible for providing information to stevedores, linemen, pilots, and port control for efficient performance. As Links (5) to (9) of figure (18) demonstrate, there is flow of key information which is either shared or updated by the agent for the berth allocation procedure. Despite this, when administrative burdens are present, inefficiency arises in berth allocation. These administrative burdens can be explained by recognising that the efficiency of availability in berth allocation can decrease because updated information on Estimated Time of Arrival (ETA), ships particulars, flags, ownership, charters, deadweight, length, net tonnage, gross tonnage, and the draught needed for berth allocation is shared by phone and / or email, and confirmation is done by email. Therefore, an alternative form of communication is needed – one that can provide a platform to share diverse forms of key information, receive continuous request updates, and contribute to a decrease in the administrative burden.

Proposition 1: All else being equal, as the centrality of actors increases (a) the likelihood of the administrative process and burden of the port authority decreases, and (b) the likelihood of other actors' collaboration increases.

The lack of a digital platform for port control to store the enquires received by stevedores by phone creates an additional manual procedure when the enquiry turns into an actual job. There is no external platform provided by port control for agents and stevedores to see the information shared by them over the period of time and the status of their order. Therefore, most of the time port control has to update using emails and phone, which adds to the administrative burden and increases the chances of mistakes being made. There is huge mistrust from agents and stevedores in respect of the digital platforms provided from port authorities. This is due to a lack of clarity in data governance and data ownership, even though most of it is master data.

All these challenges suggest that there should be a more transparent way to share and update information whilst the central actors simultaneously have control and ownership as to who gets accesses to that data. As stated above, the 'concentrated ownership' of information held by both agents and stevedores contributes to efficiency in berth allocation performance. This said, there are two types of concentrated ownership information: registry data and event data. Registry data includes the vessel name, flag name / ownership, management charter, deadweight, length, overall net tonnage, and gross tonnage draught. Event data includes the estimated time/date of arrival, estimated time/date of departure, cargo type and volume, cargo operation specified, loading, discharge, cargo manifest, and particular hazards needed. As stated in our hypothesis, an increase in the centrality of the actors may mean that a digital platform could improve the business process by eschewing redundant links. The result would be a decrease in administrative burden, with the entire process taking place online, with the long process of updating information being replaced by a system where key information is shared directly by the owners. This would also provide the central actors with control in terms of sharing by creating a transparent environment and greater trust. In turn, this would inspire more actors to collaborate with the port in using the digital platform.

Proposition 2: All else being equal, as the involvement of two or more of higher centrality actors in a network increases, (a) the likelihood of competitors' collaborating together increases, and (b) the likelihood of competitors initiating a response or a participation to an action increases.

Following an in-depth investigation into the non-redundant information held by the stevedores and agents, this study establishes that there is a lack of involvement between the two competitive stevedores and agents (who are colleagues from other departments) and their ultimate interaction with port control. As stated in hypothesis 2, agents can be encouraged via their colleagues (the stevedores) to share port call information in the same booking system when they know that the earlier cargo information has already been provided (e.g. the cargo dimensions) by the stevedore in the booking system. To protect the commercially sensitive nature of the information, the accessibility of information is held and controlled by the higher centrality stevedores in the booking system. Furthermore, only port control has access to visualising and using this information to allocate accurate berth information for intra-port operations. This will result in collaborative contributions from other non-central actors (e.g. pilots, waste pick up and linemen) who can provide supportive information (e.g. pilot ETA and pilot standby) to the booking request arranged by the agents and stevedores with port call. This increases the collaboration and participation of competitors from both central and non-central actors.

Proposition 3: All things being equal, an increase in network density (1) will create a positive increase in the bargaining power of competitors, and (2) will create a positive relationship in the whole network regrading value creation.

Following an in-depth investigation of non-redundant information held by the port actors, this study establishes that there is a lack of density in the network of crane booking procedures. The information held by both agents and stevedores with regards to the vessel and cargo contributes to the optimal planning of both quays and mobile cranes. There are untimely contributions to the calculation of the ship/commodity and crane dues. For example, non-redundant resources for port actors generally consist of accessibility infrastructure, which is optimised by the sharing or ascertaining of information. Given this, to hold information is to hold bargaining power to receive preauthorised accesses to infrastructure. As stated in the hypotheses, this study argues against the current network centrality, stating that port actors' bargaining power will increase if there is a dense network between port control, the technical department, agents and both stevedores.

This study establishes that there is a 'concentrated ownership' of essential data in the network which can be made transparent through collecting a directory of master data and event data. This same 'concentrated ownership' data also contributes to the optimal planning of berth allocation. The registry data tends to be non-changeable, and can be stored and reused when planning for a particular vessel. Event data needs to be updated regularly to be useful. Therefore, this study proposes an artifact which stores data and pre-fills the registry information of a particular vessel as soon as the agents and stevedores request a berth. This study argues that when more registry information is shared and stored with port control, the centrality of the actors increases. This artifact creates the potentiality of by port control using shared and stored data in order to decrease their administrative burden. Moreover, when an artifact is made available to central actors such as agents to update event data directly into the artifact, it also decreases the administrative burden of port control. Two improvements for increasing network density can be gleaned from part two of the analysis, and could contribute to the problem relevance of the design science.

10.1. PROPOSITION IMPROVEMENT ONE

The in-depth illustration of network density highlights efficiency in allocating the right berths to vessels at the right time decreases if the agent makes mistakes when sending emails, the updated ETA, the cargo manifest or the draught needed. This is because updates and corrections of wrong information are often required. Clear governance of data transparency should be defined, with information about who provides the data and who gets to visualise the data. This is currently not a consideration because the central actors share information through email and by phone, and these systems do not require data transparency governance.

- Lack of control when there are updates by multiple people and where there is no platform to show the same status update. This creates a missed possibility to work collaboratively and simultaneously with a range of central actors.
- Lack of trust among the competitors with regards to no transparency in information sharing and who gets accesses to what information. This decreases any further or continuous involvement between different port actors.

An online booking system will result in a positive increase in collaboration and participation by both central and non-central actors. It will also yield a clear set of guidelines about data transparency governance, which can put in motion a process of building trust between central and non-central actors. In addition, this would illustrate the network centrality of the port control's port call optimisation, i.e. the share of correctly handled ship services (arrivals/departures/in port). In the following section, a similar template is followed in exploration the current network centrality of intra-port operations.

10.2. PROPOSITION IMPROVEMENT TWO

This in-depth illustration of network density highlights that the efficiency of allocating mobile crane access to vessels at the right time decreases if the stevedores make mistakes when sending emails over the weekend, provide the wrong cargo weight, or type requests for the wrong crane. In such cases, this wrong information will need to be corrected. As with berth allocation, clear governance of data transparency should also be defined in crane allocation, with information about who provides the data and who gets to visualise the data. This is not a current consideration because the central actors share information via email and phone, and these systems do not require data transparency governance.

- Efficiency in mobile crane booking decreased because the information was shared by phone and /or email;
- Lack of consideration of the stevedore's outlook within the governance of the mobile crane planning and execution procedure even though their input was considered while the execution or interruption took place via email and phone;
- The information is dispersed across different forms of communication. This works when the port actors demonstrate considerable effort and hard work. However, the automation of some business processes could provide stevedores with better options for crane accessibility.

An online booking and optimisation platform would positively impact competitor bargaining power. A dynamic status with live updated information for all port actors would afford opportunities to all actors to provide their feedback early – i.e. at the planning rather than the execution stage. This would make the sharing pattern between stevedores transparent. There would be availability between vessels so that all actors could attain the most efficient performance, and there would be better bargaining between the competitors in terms of accessing the infrastructure.

11. ANALYSIS THREE: DESIGN SCIENCE AND ACTION RESEARCH

11.1. ARTIFACT TO OPTIMISE THE QUAY ALLOCATION AND CRANE BOOKING: MOTIVATION

The case study and the action research summarise the list of challenges faced by port authorities in their quest to achieve efficiency in port performance. As stated at the outset of this paper, our focus is on port performance indicators that fulfil certain criteria. First, the responsibility for improving the criteria belongs to the port authorities. Specifically, performance improves the selected services delivered solely by the port authority. Second, the criteria for the activity fall under the jurisdiction and legal boundaries of the port authority. So there are questions about why the port authority is responsible for improving this service and not any other actor of the community. Third, the criteria of the port activity improve the overall efficiency of the port community.

11.2. DESIGN AS AN ARTIFACT

The case study and action research analysis highlights two propositions that fulfil all three criteria. These are challenges which, when improved, can achieve higher network density, ultimately increasing the structural embeddedness of the entire port community.

With regards to efficiency in berth allocation:

1) There is a decrease in efficiency of the 'just in time' berth allocation of a vessel when an agent makes mistakes in their email detailing vessel arrival notifications to request a berth. This can also occur when the agents do not send timely ETA updates by email, when the shared cargo manifest details are not updated, or when the draught needed by the vessel is not mentioned by the agent in the initial booking request.
2) There is a lack of transparency of what has been shared between different actors and the port authority. Governance of data transparency is missing, specifically information about who provides the data and who gets to visualise the data. Currently, this is not a consideration because the central actors share information via email and phone, and these systems do not require data transparency governance.
3) There is a lack of control when there are updates by multiple people and where there is a lack of a platform to show whether the information has been acknowledged by the port authority, and whether it has been updated in their planning process. This creates missed possibilities of working collaboratively and simultaneously with various central actors.
4) There is a lack of trust between agents with regards to no transparency in the governance of shared information, who gets accesses to what information, and whether this information is only transparent to the right actors rather than everyone.

With regards to efficiency in mobile crane booking:

1) The result of information being shared by phone and via email is a decrease in efficiency of optimally sharing mobile cranes between stevedores provided by the port authority.
2) The information is dispersed across different forms of communication. This works when port actors demonstrate considerable effort and hard work. However, insights into and the automation of some business processes could provide stevedores with better options for crane accessibility.
3) The stevedores were not considered within the governance of the mobile crane planning and execution procedure even though their input was considered when the execution or interruption took place via email or phone.
4) Similar to berth booking, there is a lack of trust between stevedores with regards to no transparency in the sharing of information governance, who gets access to what information, and whether their information is only transparent to the right actors and not everyone.

11.3. PROBLEM RELEVANCE

Considering the challenges noted above of berth allocation and mobile crane booking, this paper determines that there is a need for an online booking system that provides opportunities to improve sharing and to share accurate information. We suggest that this platform should provide a dynamic status with live updated information for all port actors. This would present all the actors with the opportunity to provide their feedback early, i.e. at the planning rather than the execution stage.

This case study concludes that a booking system would increase the centrality of the port authority and increase the density of the network. Furthermore, this paper provides the following justification as to whether a booking system would provide a solution to the challenges identified in the case study, and provide a means to achieve efficiency in port performance.

1) An online booking system would lead to a positive increase in collaboration and participation by both central and non-central actors. It would also yield a clear set of guidelines about data transparency governance, which can put in motion a process of building trust between central and non-central actors.
2) In addition, this would illustrate the network centrality of the port control's port call optimisation, i.e. the share of correctly handled ship services (arrivals/departures/in port).
3) An online booking and optimisation platform would create a positive increase in competitor bargaining power. This would make the sharing pattern between two different stevedores transparent.
4) There would be availability between vessels so that all actors could attain the most efficient performance, and there would be better bargaining between the competitors in terms of accessing infrastructure.

In the following section(11.3), we adopt the conclusion of the case study as the problem relevance for designing the artifact. This artifact of an online booking system will enable this paper to investigate how the digitalisation of a booking process can increase the centrality of the port authority. This paper presents the artifact of a digital booking system which focuses on booking various port services, and argues that it would provide a solution to the challenges explained above. This artifact would consist of a booking system that delivers vessel arrival notifications, waste declaration or slap oil services orders, order pilots and a crane booking system showing all available slots. In addition to the challenges noted above, the artifact presented would also connect directly to the invoicing system so that the procedure for calculating ship, commodity, and crane dues could be simplified. The artifact would also consist of a ship registry containing a catalogue of all the vessels that have visited the Port of Esbjerg, which would lead to insights in terms of optimising the whole vessel journey in the port boundaries. Analysis two explains the implementation of the design science framework, and describes the development of the artifact, the implementation of feedback and communication of the developed artifact.

A small-to-medium sized port authority has a range of manual processes that would contribute to the efficiency of port performance. In small-to-medium sized ports, the service is limited to:

(1) Port call procedure, which includes a vessel berth allocation process, cargo loading and unloading operation, waste disposal, slap oil pickup, crew change, and provision for vessel crew and equipment maintenance;
(2) Mobile crane rentals for stevedores to load and unload offshore or project cargo;
(3) Warehouse rentals for the storing of cargo; and
(4) Land rental for offices.

These manual procedures provide an opportunity for digitalisation. The case study showed that quay allocation and crane allocation by the harbour master presented an opportunity for optimisation in terms of efficiency. 'Optimisation of efficiency' can be achieved by increasing the centrality of the port authority. As such, our motivation is to focus on increasing the centrality of the port authority by optimally designing an artifact that incorporates the solution for the problems investigated in the case study. Supported by design science, this paper explains a range of steps through which the artifact will be designed and iterated, and where the intention is to solve all the challenges mentioned in the problem relevance section.

11.4. DESIGN EVALUATION

The paper follows the evaluation of an artifact designed for the port to transition from a manual accounting application to a customised digital platform. This will optimise the berth allocation and the invoicing method for both the port authority and the agents. The second user case, that of digitalising mobile crane allocation, presents an additional functionality to the same artifact. This not only contributes to optimising the port's crane allocation but also solves the port's issue concerning limited resources, and how information transparency helps allocate its limited number of mobile cranes to the right operation. Ultimately, it is anticipated that this will result will decreased costs and increased efficiency. In the in-depth case (Section 9) the paper illustrated the problem of key information sharing in Figure 18 & Figure 19. In the section (11.4) below, we continue with the illustration of the key information flow and evaluate it into attributes required for the artifact. The attributes are defined as key information, and the content needed to digitally create and optimise the port performance processes. These attributes are the key information which will be made available in the artifact. For this we start with (1) problem summary and (2) the evaluation methodology. The paper then evaluates Figure (18) & (19), as illustrated in the case study, as the outcome of efficient network centrality. Finally, we translate the illustration into the key information needed as attributes for the artifacts.

11.4.1. PROBLEM SUMMARY

The artifact is evaluated so as to demonstrate efficacy and utility in contributing to the main objective. In this paper, the main objective of the artifact is to increase the centrality of the port authority in the network by creating a digital platform with 'information available' and 'information transparency'. This will increase the density of the network and the centrality of the port authority. Therefore, the artifacts designed will be evaluated based on the frequency of information shared to increase the information availability. When done consistently, this will enable us to achieve an increased density in the network and the centrality of the port authority. In addition, the scope of the artifact is to provide solutions to the challenges listed in the problem relevance of the paper. Before elaborating on the attributes of the design that are evaluated, the problem relevance is summarised broadly in two sections, namely:

- **QUAY ALLOCATION:** The quay allocation procedure is based on the booking request procedure (also known as vessel arrival notification) of the port authority. The vessel arrival notifications for berth requests are done through agents by email, with the updated information being provided over email. This is verbally transferred by the harbour master internally to their colleagues. This creates the opportunity for a lack of transparency for agents as to what information is being shared internally. It also means that information may not be rectified by agents, and the strong likelihood that the harbour master will miss key information. The main shortcoming of manual quay allocation is that it creates administration burdens throughout the entire network. Moreover, it decreases the centrality of the port authority. This creates conflict within the network, particularly in terms of collaboration. Mistrust can lead to a decrease in the density of the network.

- **MOBILE CRANE ALLOCATION:** The crane allocation is based on the crane booking procedure implemented by the port authority. In this procedure the stevedores book mobile cranes which are owned by the port authority. They are made available at a specific quay at a specific time for the stevedores to load and unload nacelles and wings on and off the vessel. All the stevedores book the mobile cranes by emailing the harbour master. When different stevedores book mobile cranes simultaneously, or for more hours than are required, this can create problems. Inefficient use in sharing mobile cranes by the stevedores can lead to general inefficiency across all intra-port operations. The port authority accumulates unwanted costs connected to driving the mobile cranes between different quay side locations because of the 'first come, first served' approach in operation, rather than an approach which focuses on 'more productivity and less idle time'. Similarly, as regards berth allocation, crane allocation also decreases the centrality of the port authority. The 'first come, first served' nature of mobile cranes creates conflict within the network. Specifically, it decreases collaboration, creates mistrust amongst the stevedores and contributes to an overall decrease in network density.

11.4.2. METHODOLOGY OF THE EVALUATION

The artifact should be continuously and simultaneously evaluated so that it can be improved, creating a denser network and bringing together central actor relationship ties. Having had the opportunity to be present at the research sites as an employed research consultant at both the Port of Esbjerg and the Port of Koge, it was possible to evaluate and receive feedback from experts regarding the flow of key information onsite, as well as from other stakeholders situated in the port vicinity. As an employee of these two ports, I also had access to a wide range of port actors. In order to leverage this opportunity, an action research methodology alongside a design science framework was adopted, with data collected during field visits. Data collection also consisted of presentations in councils, with invited focus groups, and through observation.

11.4.3. ATTRIBUTES EVALUATED

As described above, the understanding is that sharing key information increases the bargaining power of the central actors with regards to accessing infrastructure while simultaneously compromising on the efficiency of infrastructure performance. The objective of the artifact is to provide a platform for sharing key information to central and non-central actors alike, so that bargaining power is replaced with efficiency. The term 'platform' means a digital page which will be accessible for all central actors on the Port of Esbjerg website, where they will be able to book quays and mobile cranes for their vessel berthing and operations, and where the key information can be used by the harbour master to allocate resources efficiently. This will replace the dependency on emails and phone calls with a digital and fully accessible real time platform. The term 'key information' refers to the 'concentrated ownership' of information shared by various central actors (e.g. agents, ship captains, stevedores, the port control technical department and finance department) for booking berths or cranes at the Port of Esbjerg. To evaluate the design, we aim to translate the illustration of the key information flow into attributes so that the correct port actors receive information on the right time to perform their operations (specifically berth and mobile crane allocation) with optimal efficiency.

11.4.3.1. EVALUATION ONE: BERTH ALLOCATION

The illustration (20) below is the outcome of the in-depth case study research and action research undertaken in section (9.1) The illustration outlined below is the 'optimised' version, showing only non-redundant LINKS of the key information flow of various actors that share information for booking berth allocations. In this section, these LINKS are evaluated along with key information to understand how its inclusion in the artifact assists the berth allocation process to transition from an accounting application to a customised digital platform.

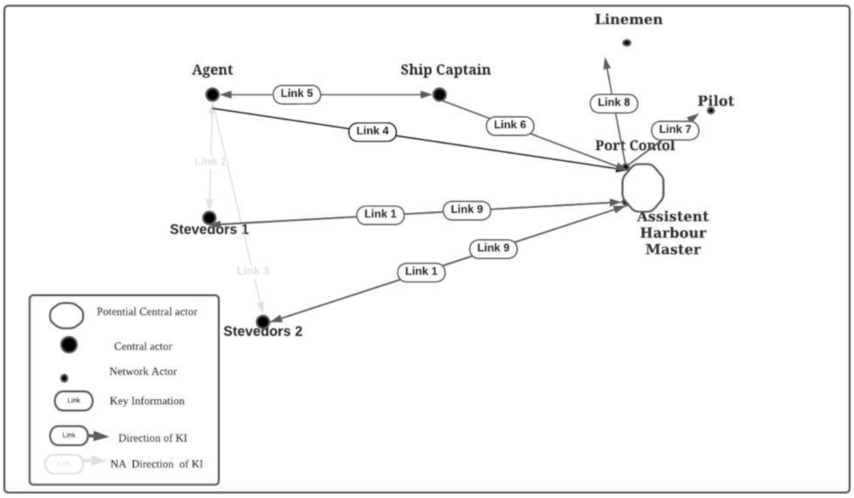


Figure 20:Optimised Network Centrality and Dense Network Density

1) STEVEDORES 1 & 2 AND PORT CONTROL (LINK 1 OF FIGURE 20)

- The stevedores receive an enquiry from the shipper for carrying out the operation of loading and unloading cargo on a vessel. The in-depth case study shows that to accomplish the operation of loading and unloading, the shipper receives key information about the 'type of cargo' and 'weight of the cargo' between three months and three weeks before operation.
- This key information is shared only with the port authority port control, and not with their own agent colleagues.
- The artifact can be used by the stevedores to complete the enquiry, rather than by email or phone. When an order page is submitted, a notification can be sent to both port control as well as the stevedores own company agents.

2) AGENT AND STEVEDORE 1 & 2 (LINK 2 AND LINK 3 OF FIGURE 20)

- The agent and stevedore are two of the central actors. They can communicate with each other internally about allocating berth requests, and then also separately with port control.
- The key information that they hold is the vessel information, which is stationary. However, cargo type and weight estimated time of arrival are periodically updated via email. This is sometimes not communicated with each other.
- The artifact makes this link 'Not Applicable (NA)' because both agents and stevedores have one order page to provide and monitor each other's key shared information.

3) AGENT AND PORT CONTROL (LINK 4 OF FIGURE 20)

- The agent is a colleague of the stevedores, and also one of the central actors in the network. They both have direct contact with the shipper, and provide most of the information about the berth allocation process.

- The key information that they hold is 'estimated time of arrival' (ETA) and 'estimated time of departure' (ETD), which are periodically updated by email. This can lead to inefficiency should the agent forget to update the port control over the weekend. In addition, 'actual time arrival' (ATA) and 'actual time departure' (ATD) are also updated by the agent. This is necessary for the port control to calculate the exact port dues.
- The artifact can help agents fill in the ETA, ETD, ATA and ATD rather than doing so by email or phone. Doing this would avoid inefficiency, decrease the agent's administration burden, and keep track of the changes between berth allocations.

4) AGENT AND SHIP CAPTAIN (LINK 5 OF FIGURE 20)

- The agent represents the ship captain in activities such as uploading the necessary documents (e.g. the manifest) with the port control, and initiating the pre-arrival notification procedures. As noted above, the pre-arrival notification is an official request made by the agent on the behalf of the shipper/ship captain for berthing.
- The key information that the ship captain shares with agents is vessel type, ETA, ETD, vessel draught, the need for a pilot, the need for provision through email, the destination port, and cargo type/weight. Agents also prepare the bill of lading and the manifest for the ship captain. This type of key information is essential in port control's berth allocation planning. If received at the same time as the agent, this adds value in the berth planning process. Although valuable for the port, accessibility to this communication is out of scope because it constitutes communication between two of their customers, i.e. the agent and ship captain.
- The artifact identifies this link as 'Not Applicable (NA)' because even though we are not privy to the communication, the artifact will provide an environment within which the agent can share the key information at the same time it receives it from the ship captain via an online form. When agents share their key information with port control as soon as they receive information from the ship captain, the necessary key information can be provided to port control to initiate their berth allocation planning some 72 hours before berthing, rather than in a 12-24 hour window. In return, the artifact can also provide the agents with a transparent status update of the berth allocation planning which port control has done, as well as an overview of all the berth requests that they have implemented.

5) SHIP CAPTAIN AND PORT CONTROL (LINK 6 OF FIGURE 20)

- The ship captains begin their communication with the VTS operators in port control when they ask to enter the port for berthing. Prior to this, communication is conducted only by their agent representative. Once the process of berthing the ship begins, the captain proceeds to updating the VTS operators about their location and the next steps, e.g. whether a pilot is needed, waste pick up, an update as to whether the berth needs shifting.
- The key information that the ship's captain directly communicates with the port

control is generally constrained solely to the VTS operators. The information consists of updates on their location in the basin, the ATA, updates about pilot boarding, requests for waste pickup, whether they have to shift berth, and their discharge request. Simultaneously, the agents represent the ship captain and carry out any and all administrative work which they require.

- Artifacts can be accessible to ship captains once they are in the port (with the permission of the agent) to request berth shifts (i.e. moving from one berth to another) after hours, to book a waste pickup and edit the time /date as required, and to submit the time and day of their ETD. The artifact can use this information to initiate the calculation of the ship dues with the relevant internal department rather than it taking between 7-15 days to calculate, confirm and send the invoice. However, this does need to be motioned as the ship captain will need to communicate with the VTS operator.

6) PORT CONTROL, LINEMEN, TUGBOAT AND PILOTS (LINKS 7 & 8 OF FIGURE 20)

- The VTS operators at port control, in some rare instances, contact pilots on behalf of the ship captains for jobs, specifically when the agents cannot be contacted because it is out of working hours. VTS operators, however, are in constant communication with tugboats. Pilots and tugboats, on the other hand, communicate with the VTS operators at port control when they are in the processes of berthing at the quay. With regards to linemen, the agent communicates the berth number, vessel ETA, and the name of the vessel to the linemen. The port control does not communicate with the linemen.
- The information shared by and with the pilots consists of the berth number, ETA and location of the vessel, and any damages occurred while carrying out the berthing process.
- The artifact can use this link to provide the opportunity for a pilot to find information about which vessels have requested pilots for their berthing procedure, including information about the berth number, ETA and vessel type and size. This can help assign pilots with the right experience to the right vessels. Similarly, tugboats can also use these insights to help their planning when resources are limited. With respect to linemen, the artifact can provide vessel ETA/ETD and can receive the ATA/ATD linemen as an additional source for verifying and calculating future ship dues. However, it should be noted that pilots and tugboat operators will still have the need to communicate with the VTS operator.

7) PORT CONTROL'S ASSISTANT HARBOUR MASTER, AGENTS AND STEVEDORES 1 & 2 (LINK 9 OF FIGURE 20)

- Port control contacts the agents and stevedores to get information about ATD, cargo discharge time, and day and berth location confirmation information in order to calculate the ship dues, and initiate the internal invoicing procedure.
- The key information about the vessel's ATD, along with the berths visited and the

cargo discharge time and date, are needed from both agents and the stevedores so as to calculate the ship dues and initiate the internal invoicing procedure.

- The artifact could incorporate this link to calculate the final ship dues as well as to calculate the mobile crane dues.

11.4.3.2. EVALUATION TWO: CRANE ALLOCATION

The illustration below is the outcome of the in-depth case study research and action research undertaken in section (9.2) This illustration outlined below is the 'optimised' version, with only the non-redundant LINK of the key information flow of various actors that share information to book the mobile crane provided by the port. This section further evaluates these LINKS, along with the key information, to understand how its inclusion in the artifact assists the crane allocation process to transition from an accounting application to a customised digital platform.

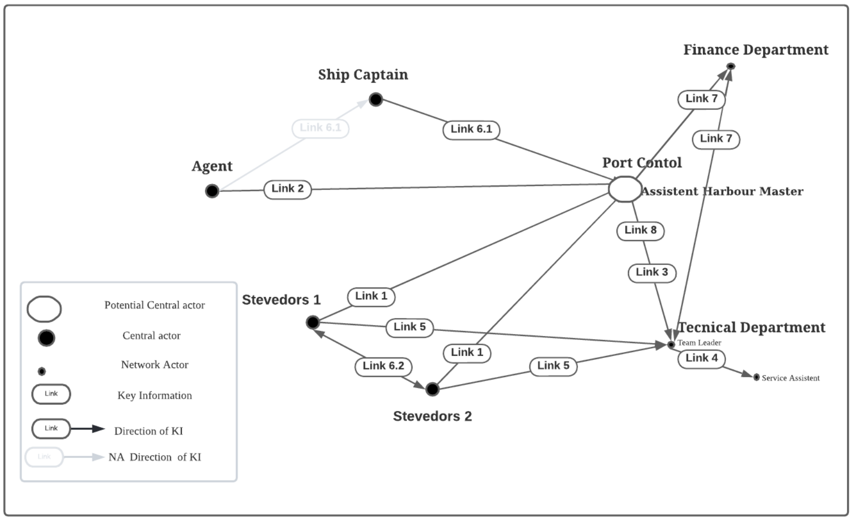


Figure 21:Optimised Network Centrality and Dense Network Density

- **STEVEDORES TO PORT CONTROL (LINK 1 OF FIGURE 21)**
    - The stevedores contact port control 14 days before the agent in order to ask whether the port can handle the cargo loading or unloading.
    - Key information about the type of cargo, volume and weight is communicated by the stevedores to port control. This communication is done over the phone and is not stored anywhere. The stevedore does not communicate this information to the in-house agent.
    - The artifact uses this link to incorporate information about the cargo so that port control has a rough idea that in a vessel will call at the port with this type of cargo in 14 days or fewer. This key information helps port control to plan the cargo position on the quayside. It can also look into whether the quay can handle the weight, and that a crane will be available for loading and unloading the cargo.

- **AGENT TO PORT CONTROL (LINK 2 of Figure 21)**
  - The agents contact the port control 24 hours before the vessel's arrival for berth allocation. The agents email information including the vessel name, cargo type, and whether or not mobile cranes are needed. Port control regularly checks email to match the vessel information sent by the agent to the stevedore's cargo information, checking whether the correct type of crane has been requested.
  - The key information shared is the length of time which the mobile crane is needed for, the length and type of crane, the type of cargo, and its volume and weight. There is a strong chance that this information will contain errors, and will require conformation and rectification over the phone by the stevedore. This adds complexity to the planning process. Furthermore, the stevedore will generally add more time to the crane booking, hence increasing its idle time. This tends to occur because of the lack of information about ETA, ATA, the berth draught, the types of crane available, and the type of berth that was assigned to the vessel.
  - The artifact can translate this link and its challenges into a more transparent process of sharing key information. The mobile crane can be reserved only when information related to the type of cargo, its volume and its weight is provided. The artifact can also take into consideration the ETA and vessel type from the information provided by the agents. This will decrease the need for port control to manually check emails to match the vessel to cargo for both crane and berth allocation. Therefore, the number of errors in the information supplied will decrease.

- **BETWEEN THE TECHNICAL AND THE PORT CONTROL DEPARTMENT (LINK 3 OF FIGURE 21)**
  - This is an internal business process between the technical and the port control department to confirm and execute the agent's order. 24 hours prior to the delivery of the mobile crane to the specific location, the assistant harbour master mails the list for the day to the service assistant.
  - The key information is the location list where the mobile crane should be driven by the service assistant. Priority is given on a 'first come, first served' basis.
  - The artifact incorporates this link to improve the overall crane allocation process, replacing the 'first come, first served' basis with a pattern based on optimal use, in which there is more operations and less driving between berths. This means the service assistant will provide the mobile cranes based on the ETA and the proximity to the next operation. This insight will be available to both stevedores and agents, as well as the technical department and port control, with continuous status updates rather just receive information at 0900 the day before.

- **TECHNICAL DEPARTMENTS TO STEVEDORES (LINKS 4 & 5 OF FIGURE 21)**
  - In this link, the mobile crane is driven by a service assistant to the location requested by the agent. Sometimes there is change of location request to move the cranes to

another location because the draught is higher. This change of request takes time to execute.

- The key information consists of the location and the time cranes are booked, as well as a verbal request to change the location of the mobile cranes.
- The artifact can solve the change in the location request due to low draught by calculating the level of draught into their crane allocation planning. As such, this decreases the possibility of receiving a 'request of change of location' from the stevedore on the day of the operation.

- **BETWEEN AGENT, SHIP CAPTIAN AND PORT CONTROL (LINK 6.1 of Figure 21)**
  - In this link the ship captain contacts the port control to inform them that they need to shift berth due to insufficient draught for loading and unloading cargo.
  - The key information is verbal information given by ship captain 30 minutes before telling the VTS operators to shift the berth.
  - In this link, the artifact allows the ship captain or their agents submitting an online request to shift the berth so that it is recorded in the system. Port control can thus consider this while updating the crane allocation plan, as well as the status of berth occupation for that day.
- **BETWEEN STEVEDORES 1 & 2 (LINK 6.2 of Figure 21)**
  - In this link the crane is idle and waiting for permission from port control to 'change location' and for the vessel to 'shift berth'. At this point, the two stevedores talk to each other to solve the crane sharing problem. This contributes to better scheduling of crane utilisation and decreases operation instructions and delays in crane accessibility.
  - The key information is the alternative plan organised between stevedores in terms of crane sharing, the change in location information, the draught level needed, the crane type, cargo type and volume.
  - The artifact changes this process so that it is transparent and digital, meaning that port control is aware of the changes undertaken by the stevedores. The artifact will consider the potential level of draught needed beforehand while planning the crane allocation so that in future there should not be a 'change in location request' for the cranes. Therefore, making this link is not applicable.

- **BETWEEN PORT CONTROL, THE FINANCIAL AND THE TECHNICAL DEPARTMENT OF THE PORT OF ESBJERG (LINKS 7 & 8 OF FIGURE 21)**
  - The service assistant collects the information from the agents and stevedores on a paper-based form. This information includes ATD, cargo discharge time, and day and berth location information, and is used to calculate the crane dues and to initiate the internal invoicing procedure.
  - The key information is the time the crane operation is stated to have ended, the crane type, the cargo type, and the cargo discharge time and date. This is needed

from both agents and the stevedores in order to calculate the crane dues, and to initiate the internal invoicing procedure.

- The artifact can incorporate this link to calculate the final ship dues and mobile crane dues, and also to verify the information from both agents and stevedores within 24 hours of the completion of the operation.

11.4.4. EVALUATED - TYPES OF CONCENTRATED OWNERSHIP INFORMATION

The following register information and event information should be available in the artifact so that the port authority, agents and stevedores are able to share information. It will also provide them with clear insights in terms of information shared and the prioritisation for accessing the infrastructure between stevedores whilst simultaneously allowing the port authority to increase their centrality and density within their network. The above evaluation shows that the following key information needs to be present in the artifact.

1. Registry information – the vessel registry data is stored in a port control system so that less time is spent asking for the same type of information from the same central actors, for example information about vessel types and their capacity. For this paper, the five type of registry data below are used.

Registry data	D Delineation
Vessel name	The name consists of the IMO number, flag, and ship name
Outreach	The distance of outreach the crane should have for loading and unloading
Draught	The level of draught/draught needed to carry out the operation
Cargo type	The type of cargo carried by the vessel
Capacity	The strength of the weight the crane can handle

2. Event data –operational data that changes in real time and needs to be updated regularly by agents, stevedores, and other actors in order to decrease operational bottlenecks.

Event data	de Delineation
Estimated time of arrival	The approximate time a vessel plans to arrive at the port
Estimated time of cranes	The approximate time the crane should be available at the quayside
Type of Cargo	The type of cargo which needs loading or unloading

No. of Cargo	The volume of the cargo, needed to calculate the time it will take to load or unload it
Cargo weight	The weight of cargo, needed to calculate the type of crane that can handle the weight
Waste Pickup	Waste pick up is an additional service provided by ports to depose of waste and recycling from vessels
Berth name and number	The berth name and number will assign the berth allocation order with the crane order

11.5. RESEARCH CONTRIBUTION AND RIGOUR

In streamlining the problem even more, we can say that the focus of this paper is on designing an artifact based on the attributes evaluated by bringing both the berth allocation and crane booking process into one platform. The creation of such a 'platform' means that all the information shared will be stored and updated in one place, and both the berth allocation and crane allocation will not be seen as two sperate procedures. The illustrated diagrams Figure (20) and (21), which detail the key information flow of both bookings, will be merged into one procedure. The merging of the two procedures will add value due to the decreased administrative burden, the increased participation with the port central network (both central and non-central), the increased bargaining power of competitors, the increased participation between various central actors to reach a balanced network centrality, and the increased number of central actors. The Figure 7 illustrates the optimal business process through which the artifact will be designed. In so doing, the following goals should be accomplished:

1. Vessel berthing: This value is captured when the vessel is allocated the optimal berth with the correct draught level so that the mobile cranes can properly access the cargo and do not have to wait for the tide to either increase or decrease to the right level.
2. Berth capacity: This value is captured when the quay is used to its full capacity and always occupied.
3. Quayside space: This value is captured when the quayside space and dimensions are transparent for better planning operation of loading and unloading cargo and handling the right dimension/weight of cargo on the right quay. This is to avoiding risk of damage to the quay side.
4. Mobile crane: This value is captured when the mobile crane is used optimally to load and unload bulk cargo, ensuring that it is not necessary to drive from one berth to another, which costs money. Optimisation is achieved when the mobile crane is shared efficiently with maximum output and less drive time, rather than on a 'first come, first served' basis.
5. Accessibility to the Hinterland: This value is captured when the yardside is used to store and connect to road and rail, so that Self-Propelled Modular Transporters (SMPT) and mega cargo (e.g., wings, nacelles etc.) can be navigated towards the quayside without disrupting other quayside operations.

11.5.1. ARTIFACT'S CONTRIBUTION TO VALUE

Taking these values added goals into consideration, the information flows of both berth allocation(Figure 20) and mobile crane allocation (Figure 21) are combined in one diagram (Figure 22). This section Figure 22 demonstrates the sharing of key information between various central actors, and increases the density of the port control. Using network centrality, the paper established three areas of contribution, namely increasing the centrality of actors, increasing the collaboration between competitors, and creating a denser network. To accomplish this, interviews were conducted with the port control department, finance department, commercial department, and IT department to illustrate the most essential network central actors and their communications. Enquiries were made into the key information needed to solve the non-efficiency problem for berth and mobile crane allocation efficiency, as explained in Section 11.4.3.1 and Section 11.4.3.2 represents the outcome of those interviews, taking them into account in Section 11.5.1. The three port authorities, the Danish Ship Broker Association, the Danish Freight Forwarding Association and the stevedores, were all interviewed to confirm the key information needed to be present in the artifact. This was followed by a communication with a management-oriented audience for an internal workshop with direct reports to the CEO to decide whether it was optimal to merge the solutions to two different problems in one platform. This workshop also included the port control, tech leaders, finance representatives and service assistants. The outcome of this workshop was that the two business processes should be merged into one, thereby illustrating the overall contribution to the artifact and value. The following section explain the details of the efficiency value added by the artifact and illustrates the role of the artifact in increasing the port authority's centrality, increasing the collaboration between competitors, and creating a denser network. Figure 7 shows the merger of the two different business processes, along with the key flows between central actors, which are highlighted or greyed-out to demonstrate the artifact's contribution to the newly-merged key information flow.

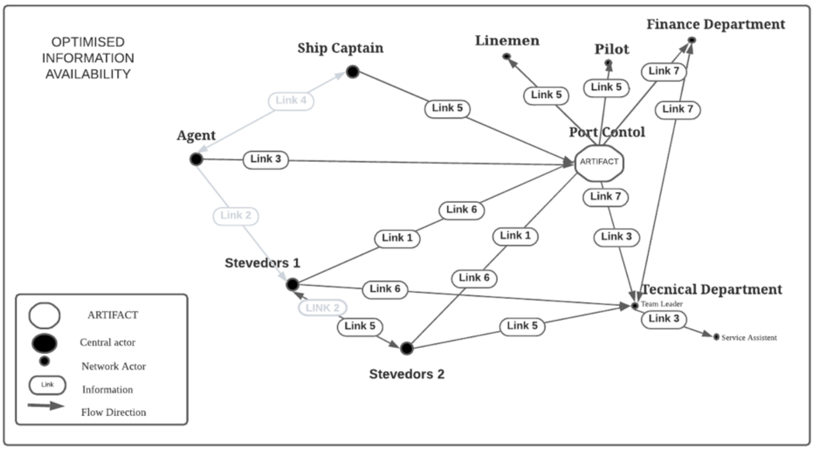


Figure 22: Merging of Two different Business Process

- **CONTRIBUTION TO THE ARTIFACT FROM STEVEDORES 1&2 TO PORT CONTROL (LINK 1 OF FIGURE 22)**

The artifact recognises the two stevedores as central actors. They receive requests of order from the shipper anywhere between three months and three weeks before the agents are hired, or a vessel is chartered to call the port. They possess information related to the type, size and volume of the cargo. They email or phone the port control with the enquiry, a form of communication which will be replaced by the artifact. As such, this contributes to the value of optimising quayside space, mobile cranes, and accessibility to hinterland.

- **CONTRIBUTION OF THE ARTIFACT FROM AGENT TO STEVEDORES 1&2 (LINK 2 OF FIGURE 22)**

The artifact recognises the importance of the agent's communication with their stevedore colleagues. This information flow shares the key information (ETA, bill of lading from the shipper, manifest from the vessel and vessel registry, and crew provision list), capabilities (planning the assignment/order, contacting the transport for hinterland connectivity) and assets (technical assets such as AutoCAD, or operation assets such as self-propelled modular transporter (SPMT)) which is shared between the agents and stevedores. It is important to note that the communication between agents and stevedores, who are colleagues and belong to the same company, are not shared with port control because the port authority has no jurisdiction over these activates. As such, the internal communication transparency between the agent stevedores is out of the scope of this artifact. Some key information from this link is provided in LINK 3 and LINK 6 of the artifact.

- **CONTRIBUTION TO ARTIFACT FROM AGENT TO PORT CONTROL (LINK 3 OF FIGURE 22)**

The artifact recognises the agent's communication with port control. This highlights that the only key information shared between port control and the agent, who is the representative of the shipper and the actor responsible for constantly being in contact with the vessel and updating the port, is the ETA. This is a crucial link for the Port of Esbjerg to achieve improved efficiency in terms of port control's port call optimisation performance, where information about indicators for sharing correctly handled ship services (arrivals/departures/in port) is owned by the Freight Forwarders Association. Simultaneously, the business process to confirm the crane and berth booking commences between the technical department and the port control department. The technical department is involved in discussing the best practice for crane sharing with the two stevedores. This takes place with the agents a few days before, rather than just 24 hours, thereby improving the efficiency of crane planning. The artifact will gather all the relevant information in one place, meaning that everybody is involved from the very beginning. The added value to berth capacity is added to vessel berthing in the planning phase, rather than being onboarded unnecessarily late in the process.

- **CONTRIBUTION TO THE ARTIFACT FROM AGENTS TO SHIP CAPTAINS (LINK 4 OF FIGURE 22)**

The artifact recognises that the agent's communications with the ship captain is sensitive in nature, and also outside the scope of the artifact. This link consists of information between central actors that is essential for port control's berth allocation, and also in some cases for allocating multiple berths to a vessel for different operations. The most important key information to receive is the actual time of departure (ATD) of the vessel, based on which the ship dues are calculated. However, port control is not privy to their communications, and to some extent this is out of scope for the artifact. However, the artifact will solve the problem by making key information such as berth number and type of crane provided accessible to the vessel captain (LINK 5) so that they can view it, with the consent of the agent. This therefore contributes to the value of optimising vessel berthing, berth capacity quayside space, and the sharing of mobile cranes.

- **CONTRIBUTION TO THE ARTIFACT FROM THE SHIP CAPTAIN TO PORT CONTROL AND STEVEDORES 1&2 (LINK 5 OF FIGURE 22)**

The artifact recognises that the agent's communications with the assistant harbour master and vessel captain initially happens through the VTS network, whereby port control is officially updated about the vessel's position, its approach towards the berth (e.g. ATA) and its departure or shift to another berth (e.g. ATD). The conversation between the linemen and the port control and pilot is essential. Whilst none of these three groups are central actors, they do however play an important role in adding value in vessel berthing, berth capacity quayside space, and the sharing of mobile cranes. Therefore linemen and pilots are sent notifications from the ship captain in the artifact. The sharing of key information occurs when the vessel captain contacts port control with a request to navigate towards the allocated berth location. With access to the artifact, the stevedores are kept informed about the movement of both the crane and the berth occupancy. The increase in participation between central and non-central actors, as well as the increased transparency of information about the berth and mobile crane status, helps us eliminate the previous inefficiencies which were visible in the problem relevance.

- **CONTRIBUTION TO THE ARTIFACT FROM STEVEDORE TO THE TECHNICAL DEPARTMENT (LINK 6 OF FIGURE 22)**

The artifact recognises that the stevedore to technical department key information flow encompasses the final communication as to whether the job was completed, or whether there was any issue, for example that more time was needed with the crane, or that there was an interruption due to the crane breaking down. Whatever the situation, these unforeseen events are communicated to the port control department. The artifact will make it possible for the stevedore to submit their total time of crane usage. If there is an interruption due to a breakdown or accident, then the stevedore must call port control because it is outside the scope of this artifact.

- **CONTRIBUTION TO THE ARTIFACT FROM THE FINANCIAL DEPARTMENT, TECHNICAL DEPARTMENT AND PORT CONTROL (LINK 7 OF FIGURE 22)**

This is the internal information flow between the financial department, technical department, and port control. It oversees the invoicing process following the completion of the vessel discharge procedure, and in so doing generates the ATD. This information is used to calculate the ship dues and commodity dues for the agents in the future artifact. It therefore contributes to the overall value of creating efficiency in both berth allocation and mobile crane allocation, meaning that ultimately the correct amount of port dues will be calculated.

In order to establish research rigour, this illustration was then communicated to a management-oriented audience as well as a technology-oriented audience. The artifact was also used in a hypothetical test at the port control centre to see whether it encompasses all the processes, and whether it needed to be further developed. This illustration was also shared with the five agents and two stevedores, who represent the ship captains. The result of the initial illustration was a critical success. The artifact was then further iterated by conducting interviews in two other ports, and collecting feedback based on participants observation of the artifact over the subsequent twelve months. This is explained in more detail as a search process, along with the final artifact, in the next step of the design science framework.

11.6. DESIGN AS A SEARCH PROCESS

In the search process, the comprehensive data collected from the contribution section are taken and translated into a first draft of an artifact. The intention of the first draft of the artifact is to 'decrease administrative burden' by gathering all the essential 'key information' required by the different departments of the Port of Esbjerg. The following information demonstrates the series of drafts and iterations which the artifact underwent during the search process.

11.6.1. DRAFT PART ONE

Booking Berth Request: Vessel Name (Hide/Open)

Breath Request by Stevedore. Attach to system or email and it will directly appear her or they will have to fill it in hear.

Cargo Operation:

Offshore☐ Crew Transfer vessel ☐ Repair of Drilling Rigs ☐ Provisioning ☐ Chimney ☐ Cargo(in/out) ☐ Blades ☐ Fish Boats ☐ Offshore installation vessel ☐ Crew Change ☐ Locomotive ☐ Rotor ☐ Pilot Boats ☐ Repair Layoff Vessel ☐ Car Carrier ☐ Cruise Ship ☐ Chemical Offshore ☐ RoRo ☐ Gravel ☐ Nacelle ☐ Fish oil ☐ Repair vessel ☐ Aluminium ☐Liquid product ☐ Potatoes ☐ Tower ☐ Fish Meal ☐ Decommission ☐ Project Cargo ☐ Demobilising offshore vessel ☐

Draft: Please click the closet

6,7 ☐ 5.5 ☐ 7,6 ☐ 5.0 ☐ 9,3 ☐ 3.9 ☐ 10,5 ☐

Draft: ☐
Cranes: Yes ☐ No ☐
Move to Crane Booking
Now ☐ Later ☐
Waste Yes ☐ No ☐

Figure 23:Draft One of Berth Request

The first key information added to the artifact to capture the value to receiving information was three months to three weeks prior. The first artifact required a 'vessel name' to initiate a request. When an agent submits a vessel number, a temporary order number will be generated. Once the cargo details were filled in by the agent or stevedores, a fixed order number for that specific vessel was received.

- *OPEN-HIDE:*
  It was suggested by the agents and the stevedores that there should be an 'open and hide' option of the vessel name so that they have control on when to make the vessel name transparent to port control. As such, the artifact does allow the possibility of hiding the vessel

from the summary view should the agent not wish to make that information known to port control at that stage.

- *VESSEL NAME*
  In addition to the vessel name, the artifact will also consist of key information such as the agent's name, estimated time of arrival, cargo weight, cargo operation and waste pick up request.

- *TICK FOR DRAUGHT*
  The artifacts also consist of the draught needed for the vessel, which when filled notified the stevedore that they should check the draught. This generates a list of available berth slots at the mentioned ETA, and the level of draught available at the time of the ETA.

- *TICK FOR CRANES*
  Due to the merged business process, the artifact will give the agent the opportunity to apply for a mobile crane. If the agents check the YES box, then a crane order is generated should it not already exist. This, along with a link of the order number generated when the vessel name is submitted, is sent as a notification to the stevedore that a berth has been selected for specific cargo. Both the agents and the stevedore can request a mobile crane and give the detail later in the artifact. The expected usage time of the cranes is prefilled in the crane booking system. The artifact then shows the stevedore the list of available crane slots, and if a slot is selected, the agents receive a booking confirmation from the port control stating that the 'booking of berth and crane booking is confirmed'. This is done via email or can be checked on the port's website where the artifact exists, or it is connected to their scheduling plan via API.

11.6.2. ITERATION 1

Berth Available:

Terminal	Street	Quay
6. Bassin	Doggerkaj	83
		84
		85
	Vikingkaj	87
		88
		89
	Shetlangskaj	90
5. Bassin	Lonningen	60
		64
		65

Seen (Whom)

Confirm ☐ (Whom) Date Time
Revise ☐ (Whom) Date /Time

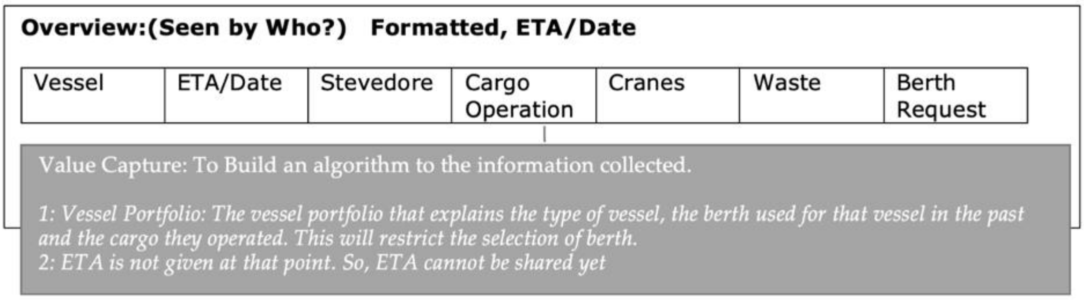
Overview:(Seen by Who?) Formatted, ETA/Date

Vessel	ETA/Date	Stevedore	Cargo Operation	Cranes	Waste	Berth Request

Figure 24:Iteration 1

For implementation applicability, two test cycles which solicited feedback from port actors were undertaken, including a request for specific feedback based on their previous input. In our first test cycle, the booking system was presented to port control for feedback. It was suggested that port control test whether the artifacts are asking the right questions.

Figure 25:Overview



- *BERTH AVAILABILITY*

  Berth availability is based on the key information of ETA, draught, and type of cargo. In the artifact, the berth availability gives the agents insight into the available berths for their operations and an opportunity to request a certain berth so that all their similar operations can be carried out close to each other.

- *OVERVIEW*

  Port control suggests it would be beneficial for agents to have a single list overview of all the berths they have booked, along with details of who edited the information most recently. This Would not only make the information process more transparent, it would also encourage agents and stevedores to share their key information, thereby adding value. The Figure 10 shows the translation of the input from the first iteration into application. An overview of all the jobs that the agent has requested and 'who has seen' this information as a monitoring functionality is provided. In addition, the artifact will include a metadata catalogue and master data database that will store all the master data used to prefill information when a repetitive job is generated. Based on this functionality, when the agents fill in the ETA and check the prefill information, it will automictically suggest berth availability as well as the availability of cranes. Draft part two presents the second part of the artifact, namely the crane booking system. As illustrated in the merged key information flow, it is essential to look at both these operations as interconnected in order to achieve efficiency and decrease the administration burden. Having finalised the berth allocation part of the artifact, the focus shifts to the feedback received for the crane booking part of the artifact.

11.6.3. DRAFT PART TWO

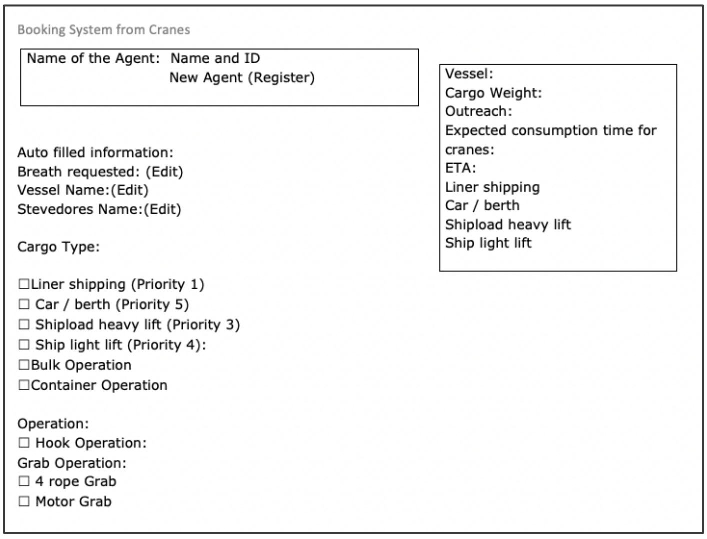


Figure 26:Draft Two of Crane Booking

- *NAME OF THE AGENT*
  The name of the agents consists of the name, a unique customer ID number which will either have been registered, or a new agent can register themselves in the system. The system remembers them for future orders.

- *VESSEL NAME*
  The vessel name in the crane booking system should be the same as the vessel name in the berth system so that the two bookings can match and connect to each other. The overview in the artifact presents us with insight into which vessels are matched with the crane booking system. If a vessel is missing with a crane booking, the agents can now revise the berth booking by ticking YES at the box mentioned 'cranes" and ticking NOW in the 'moving to the crane booking'. It is then possible to fill in the vessel name and connect the crane booking to the berth booking.

- *OUTREACH*
  Outreach is the range of the crane from the boom tip to the crane's hook, which is needed to reach the cargo stored at any length of the berthed vessel. The ports own multiple mobile cranes with different types of outreach. It is therefore possible to provide the right outreach to the right vessel, otherwise the cranes may be too short to reach certain cargo on the starboard side. The artifact compared the outreach information to the vessel type information, and suggested the appropriate crane type to the stevedore. The artifact checks this information by comparing past orders based on the same type of vessel before confirming the crane. With this information, the mistake of allocating the wrong crane to the wrong vessel can be avoided. 'Change of location request', where the stevedore has to request port control

to change the location of the vessel because the draught is high and the crane cannot reach the deck or the starboard side of the vessel, can also be avoided.

- *ESTIMATED TIME OF ARRIVAL*
  The estimated time of arrival is the time, location and date a vessel has estimated they will call the port. Once the ETA is provided, the artifact combines the outreach and crane type to provide a list of crane availability along with time slots for booking once the vessel reaches port.

- *STEVEDORE*
  The name of the stevedore consists of the name and a unique customer ID number which may already have been registered or which the stevedore can register themselves in the system. The system will remember them for future orders.

- *BERTH REQUESTED*
  With the information of the vessel name and the agent's name, the artifact will derive the different berth selected by the agent in the berth booking system. The overview shows the berth requested along with the cranes selected, vessel ETA, the stevedore's name, the cargo type and operation.

- *CARGO TYPE*
  In this part of the artifact, we investigate whether it was sufficient for the crane booking to simply have a YES or NO tick box, whether the artifact asks for the right information from the agent and the stevedores, and whether 'notification send to the customer' will decrease enquires form agents and stevedores. The feedback received form the first test cycle was that the artifact should create a system which can clarify the type of cargo for which the agent is requesting the crane. A further suggestion made was that a priority scheduling algorithm be included, whereby the cargo type becomes the priority for the scheduling algorithm, and the schedule that is generated focuses on who gets the crane first based on cargo type. In the case of a double booking, the crane is prioritised as follows:

1. Line shipping;
2. Shipload heavy lift;
3. Ship light lift;
4. Car / berth.

Based on the artifact, port control determines at any time the order in which ships are awarded a crane. This order is as follows:

1. Line traffic will be the first to the crane stevedore, but has entered into an agreement with port control. In case of breakdown, the artifact makes the next available crane. Linear traffic, in which no special agreements have been entered into in advance, have no special rights.

2. Ship heavy lift is where the burden cannot be compared, then the crane that can make the most benefit is allotted to the stevedore.
3. Ship light lift. Handling of goods between ship and dock.
4. Car / berth. Handling of non-ship-related goods.
5. Others: Charges / loads that have started, as a rule, must be completed. However, in case of delays, it is required that the stevedore concerned complete the project as soon as possible. However, a long-term project may be delayed to such an extent that it is desirable (i.e. economically most advantageous) that the subsequent project is given priority. For example, the port technical team crane is frequently scheduled for loading huge wind turbines onto vessels. The crane requires a lot of manoeuvring, and its handling can be visualised on AutoCAD in meticulous detail to predict any delays.

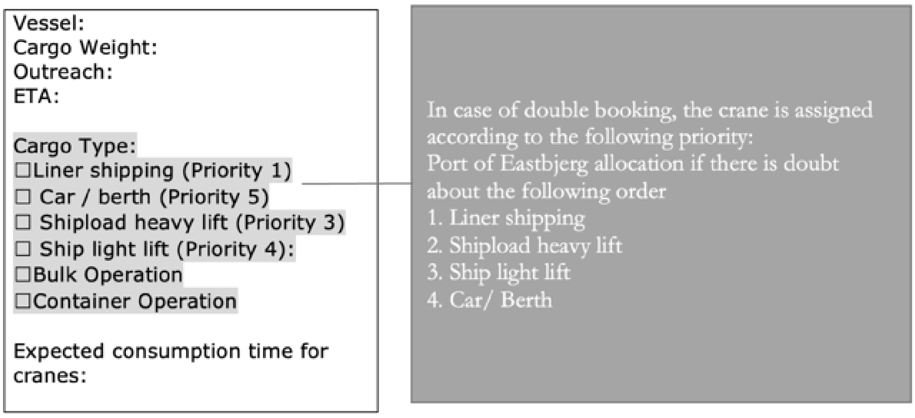


Figure 27:Cargo Type

- *EXPECTED TIME OF COMSUMPTION*
  Further suggestions included that, in due course, the artifact would also show the 'expected consumption time for cranes' based on the type of cargo. Encouragingly, the technical department noted that the artifact would also add value to their customers, who have an official checklist for the whole operation, and the digital artifact would be an added value to their whole procedure. As such, the participation of agents would be increased, and the administration burden decreased. Figure 27. shows the translation of the input from the first test cycle into application. The artifact includes the type of cargo, so that a potential priority scheduling algorithm could also be included. Furthermore, the artifact includes the expected time of consumption based on the cargo type and cargo weight (as shown in the original artifact shown in Figure 26.

- *OPERATION*
  There are two type of operation – Hook or Grab operation. A hook operation is where the crane has a hook at the end and can be used for loading or unloading bulk cargo. A grab operation can be four rope grabs for bigger cargo like operation cargo, for example the wings

of a windmill or nacelles. The hook grab is generally used for unloading and unloading single pallets. Based on the operation, the artifact suggests the type of crane suited to the operation.

11.6.4. ITERATION 2

- *REQUEST TO CLEAN THE BERTH*
  Port control suggested that the artifact should include an option where agents or stevedores could request cleaning of the quayside where the operation took place. In some instances, there is some spillage or debris which can hinder the next vessel and their operation. In such circumstances, the agents can ask for clean-up to port control.

- *CRANE TYPE/TIME SLOT*
  The artifact provides the crane type and time slot availability based the vessel type, ETA, priority of the cargo type, outreach, operation, expected time of consumption and the berth requested. Once this information is filled in, the artifact presents the stevedores with various options for cranes. Once the time slots and crane have been selected, the information appears in the overview alongside the berth requested.

Crane Type	Time Slot					
LHM280 SN:140671	06:00-07:00	07:00-08:00	08:00-09:00	09:00-10:00	10:00-11:00	11:00-12:00
	12:00-13:00	13:00-14:00	14:00-15:00	15:00-16:00	16:00-17:00	17:00-18:00
	18:00-19:00	19:00-20:00	20:00-21:00	21:00-22:00	22:00-23:00	23:00-24:00
LHM 500 SN:140.557	06:00-07:00	07:00-08:00	08:00-09:00	09:00-10:00	10:00-11:00	11:00-12:00
	12:00-13:00	13:00-14:00	14:00-15:00	15:00-16:00	16:00-17:00	17:00-18:00
	18:00-19:00	19:00-20:00	20:00-21:00	21:00-22:00	22:00-23:00	23:00-24:00

Figure 28:Iteration 2

11.6.5. ITERATION 3

Feedback was also received from the Danish Shipbrokers Association, the Danish Freight Forwarding Association, and the Danish Port Association in terms of its attributes and the implications for efficiency. In our management-oriented communication, the booking system was presented to the Danish Shipbrokers Association and the Danish Freight Forwarding Association to give feedback as to whether the artifact adds value capture for their members (i.e. agents, transport companies and stevedores).

- Their first input regarding the artifact was that it should be clear to both the agents and the stevedores (key information owners) who has access to their information when they use it. The reason for this is that most of the information present in the artifact is commercially sensitive information, and therefore it should not be visible to other agents or stevedores without their agreement.

- Their second input is that, in order to add value to agents and stevedores, the artifact should collect data via an API from the agents' scheduling platforms, or else prearrangements to prefill information should be made for vessels which are already known to the port authority so that the agents do not have to complete this information again. They also emphasised that if the artifact presented a summary of all the different jobs requisitioned by agents and stevedores at the Port of Esbjerg, this status would help agents inform their own stakeholders and avoid multiple confirmations with port control.

11.7. COMMUNICATION

The final step in the design of the artifact is communication. This divides its communication into the content and the level of content based on its audience. In the research, the frequency is generally not specified, but in this paper the communication step of the design science was not the last step. Rather, it was carried out following the conclusion of the exploratory case study, which is recognised as the problem relevance. The first audience is a *management-oriented audience*, where the communication is done with the intention of providing information that demonstrates how the artifact adds value for the customer problem, and how the artifact contributes to specific indicators that measure efficiency in port performance. The second audience is a *technological-oriented audience* where communication consists of an information dense presentation and demos that enable them to carry out the implementation of the artifact. To accomplish a consistent communication stream, this paper decided to stick to two forms of communication. The first is a presentation (slides) format used to delineate information in meetings, to use in workshops, and to easily share information. The second is a demo format to visualise the artifact for encompassing a diversified form of audience with regards to their expertise. Table 14 presents the dates and timeline of the communication. This tables illustrates the frequency of the communication held and the type of audience. This table also provides information on the medium used by the paper to communicate to the audience.

Table 14:Communication Timeline

Communication date	Audience
31st January 2018	management-oriented
29th April 2018	management-oriented
15th August 2018	management-oriented
14th October 2018	management-oriented / technological-oriented
25th October 2018	management-oriented
15th February 2018	technological -oriented
20th March	technological -oriented
16th April 2018	technological -oriented
17th July 2018	technological -oriented
14th October 2018	technological -oriented /management-oriented
26th October 2018	technological -oriented

11.7.1. AUDIENCE

MANAGEMENT-ORIENTED AUDIENCE

The management-oriented audience of our paper consist of the C-level management of the Port of Esbjerg. The artifact was introduced to the C-level in a continuous process spread quarterly across 2018, with three main workshop and outcome meetings.

1) The initial communication was done in quarter one (Q1), where the problem was recognised. We presented a three-hour workshop with the management of the Port of Esbjerg, discussing the inefficiencies of the berth allocation and crane allocation, and agreeing with them whether these issues are important for their port performance (See: problem relevance). The management level consists of the chief executive officer (CEO), chief finance officer (CFO); chief operational officer (COO), and chief commercial officer (CCO). The medium of communication consisted of a presentation format and feedback session. In this workshop we discussed the challenges of berth allocation and mobile crane booking, and how this contributed to a decrease in density of the port authority, and eventually how this would decrease the efficiency of the port performance. As stated in the problem relevance section, this paper determines that there is a need for an online booking system that provides the opportunity to improve sharing and to share true information. As such, in this Q1 workshop, we suggested that this platform should provide a dynamic status with live updated information for all port actors. This would allow each actor to provide their feedback early – i.e. at the planning rather than the execution stage. The feedback received in this session was incorporated into the next step of design evaluation (Section 11.4). Specifically, the feedback consists of creating an artifact that is simple (low in cost) and easily enabled by technical experts (quick deployment of the artifact) and meant that it was possible to increase the density of the network and the centrality of the port authority (increase in data sharing).
2) In quarter two (Q2) and quarter three (Q4), in order to communicate the artifact iterations to the executive board, a master slide deck consisting of a vision, mission and methodology was developed to explain the iteration of the booking system and how it impacts the port of Esbjerg, as well as test the future communication procedure between port actors and port control.
3) In October 2018 (Q4), the last workshop was held for final iteration, and was presented and discussed with C-level management. This workshop also included the technological -oriented audience, and had two objectives. By including the technical department, alignment was achieved in terms of the various attributes that realise efficiency in port performance (see section: design evaluation). Wanting to emphasise the need for this artifact, a simple insight into the current business process of the crane and berth allocation was provided. This was then compared with the new business process that the artifact had introduced. The presentation was concluded by sharing the quotations received from port actors, who also gave feedback on the value of the final version of the artifact. The purpose of this was to help C-level management shift their mindset towards a less administrative and more autonomised business process. The technological-oriented audience was present to listen to management's reply about future commitments in terms of enabling the artifact. The conclusion of this meeting was to hand over to the technological-oriented audience to organise the internal resources required for enabling the artifact.

4) The outcome meeting was presented to all the Danish port directors at the Danske Havnes Direktør Forum 25th October 2018, held at Lindø Port in Odense. A range of directors from the Port of Odense, Port of Køge, Port of Alborg, and Port for Aarhus were present for the purposes of triangulation throughout Danish ports regarding the outcome of the artifact. The content of the presentation (Figure 31) highlighted the way in which the artifact could contribute to a small-to-medium sized port authority which has various manual processes. There is scope to time limit port call procedure (including a vessel berth allocation process, cargo loading and unloading operation, waste disposal, slap oil pickup, crew change, and provision for vessel crew and equipment maintenance) and mobile crane booking (for stevedores to load and unload offshore or project cargo). The C-level management (the director) at the Port of Køge replied that the artifact would add value for them. The experts in the group suggested that it should be called a port call optimisation artifact. When the vessel calls per day increased to a level where they could no longer be handled manually, they would need to transition into a digital business process so that they could respond quickly to their port actors.

TECHNOLOGICAL-ORIENTED AUDIENCE

The technological-oriented audience for our paper consisted of the port control, technical department, IT experts, the external supplier of Havn2000, the developer team (external) and the technical team of the Havn2000 Webmægler. The artifact was introduced to C-level management in a continuous process spread quarterly across 2018, with three main workshop and outcome meetings.

1) In February 2018 (Q1), the merged business support illustration was communicated to the operational experts in final version. The intention of this communication was to update them about the whole methodology of the merged business support illustration, and to help shape their mindset and see alternative ways of working. Communication was done through a company article in the newsletter which informed them about the development and insights of merging the business support of the two different operations. The article emphasised the new 'digitalised' way of working, and the expectations for each person involved. Feedback was received following the publication of the article. This feedback gave more clarity on the mindset of the internal experts on the merged support illustration, and how it could contribute to their work.
2) In March 2018 (Q1), the completed 'draft one' was communicated to the IT experts, port control and the technical department in a departmental meeting. Providing them with an update on the artifact and the methodology which had been used, interviews were undertaken to gather feedback on draft one. The intention of this communication was to update the internal IT experts who were working on similar developments and projects.
3) In April 2018 (Q2), the iteration of draft one was completed, and draft two was communicated to the IT experts, port control and the technical department in a departmental meeting. Providing them with an update on the iterated artifact and the new elements added, interviews were undertaken to gather feedback on draft two. The intention of this communication was to update the internal IT experts who were working on similar developments and projects, and to discuss the applicability of this particular project.
4) In August 2018 (Q3), a presentation and a three-hour workshop was held in ADP port to

present the artifact's outcomes. Attendees at this meeting were the members of the Havn2000 technical team. Havn2000 is a team of experts from each Danish port who collectively discuss the development and adoption of digital software for ports. Presenting the artifact to experts for their views contributes to increasing the efficiency of the business process of crane and berth allocation. It was decided that the Havn2000 team would take over the implementation of this artifact into their development backlog. Other port members of Havn2000 were also present in the meeting, and showed interest in the artifact and its applicability to their own port's website. The presentation consisted of a master slide deck, and a demo of the artifact was also added, which showed how it would be used by a customer, and what the front-end aesthetic of the artifact would look like. This demo presented a 'customer journey' when the artifact was visited, showing how it would change the way they could interact with the Port of Esbjerg.

5) In October 2018 (Q4), the iteration of draft two was completed. The completed artifact, which emerged out of drafts one (Figure 29) and two (Figure 30), was communicated to the IT experts, port control and the technical department in a departmental meeting. In this meeting, the different dependability we will have on registry data and event data was discussed. Furthermore, we discussed investing into updating into the cloud or a new database in order to manage these artifacts, as well as new external professionals who might be needed to build the artifact.
6) In October 2018 (Q4), a two-day 'Direktør Forum' was held at Lindø Port in Odense. On the first day, presentation(Figure 31) was given to the Danish port directors to discuss the management implication on the artifact. Directors from the Port of Odense, Port of Køge, Port of Alborg, and Port for Aarhus were present for the purposes of triangulation across Danish ports regarding the outcome of the artifact. On the second day of the conference, technical experts from consultancies, researchers, and lobbyists were present for the presentation. They saw the need to customise this artifact to fit the business processes of small-to-medium sized ports.
7) In November 2018 (Q4), a meeting was held with an external development supplier and Havn2000 members to discuss next steps for the artifact. In this meeting, discussions were held on the resources needed to build this artifact based on the demo presented (Figure 16), the value it would add to the port community, and the increase in competitiveness of being a digitalisation port.

12. CONTRIBUTION

12.1. ARTIFACT CONTRIBUTION TO EFFICENCY

This contribution of this paper lies in its artifact of Figure 29 and Figure 30. The artifact, also known as 'port call optimisation artifact', was created so that it could contribute to the efficiency of port performance. Initially the performances selected were berth allocation and crane allocation as they are a core service provided by the port authority to its port community. The in-depth analysis of part one and part two shed light on the inefficiencies of the administrative burden of customers and port authority alike, the short duration between planning and execution and the absence of data transparency. These inefficiencies contributed to a decrease in network centrality of the port authority, increased their structural hole, and created a less dense network. Therefore, the artifact had the opportunity to create an environment of access to information. This paper contributes the artifact as a form of access to information and interaction while providing a solution to the previously described inefficiencies.

Booking Berth Request: Vessel Name (Hide/Open)

Breath Request by Stevedore. Attach to system or email and it will directly appear her or they will have to fill it in hear.

Cargo Operation:

Offshore☐ Crew Transfer vessel ☐ Repair of Drilling Rigs ☐ Provisioning ☐ Chimney ☐ Cargo(in/out) ☐ Blades ☐ Fish Boats ☐ Offshore installation vessel ☐ Crew Change ☐ Locomotive ☐ Rotor ☐ Pilot Boats ☐ Repair Layoff Vessel ☐ Car Carrier ☐ Cruise Ship ☐ Chemical Offshore ☐ RoRo ☐ Gravel ☐ Nacelle ☐ Fish oil ☐ Repair vessel ☐ Aluminium ☐Liquid product ☐ Potatoes ☐ Tower ☐ Fish Meal ☐ Decommission ☐ Project Cargo ☐ Demobilising offshore vessel ☐

Draft: Please click the closet

6,7 ☐ 5.5 ☐ 7,6 ☐ 5.0 ☐ 9,3 ☐ 3.9 ☐ 10,5 ☐

Draft: ☐
Cranes: Yes ☐ No ☐
Move to Crane Booking
Now ☐ Later ☐
Waste Yes ☐ No ☐

Berth Available:

Terminal	Street	Quay
6. Bassin	**Doggerkaj**	**83**
		84
		85
	Vikingkaj	**87**
		88
		89
	Shetlangskaj	**90**
5. Bassin	**Lonningen**	**60**
		64
		65

Seen (Whom)

Confirm ☐ (Whom) Date Time
Revise ☐ (Whom) Date /Time

Overview:(Seen by Who?) Formatted, ETA/Date

Vessel	ETA/Date	Stevedore	Cargo Operation	Cranes	Waste	Berth Request

Figure 29:Artifact 1

Booking System from Cranes

Name of the Agent: Name and ID
New Agent (Register)

Vessel:
Cargo Weight:
Outreach:
Expected consumption time for cranes:
ETA:
Liner shipping
Car / berth
Shipload heavy lift
Ship light lift

Auto filled information:
Breath requested: (Edit)
Vessel Name:(Edit)
Stevedores Name:(Edit)

Cargo Type:

☐Liner shipping (Priority 1)
☐ Car / berth (Priority 5)
☐ Shipload heavy lift (Priority 3)
☐ Ship light lift (Priority 4):
☐Bulk Operation
☐Container Operation

Operation:
☐ Hook Operation:
Grab Operation:
☐ 4 rope Grab
☐ Motor Grab

Is the port responsible for cleaning the quay?

☐Yes
☐No

Crane Type Time Slot

LHM280 SN:140671	06:00-07:00	07:00-08:00	08:00-09:00	09:00-10:00	10:00-11:00	11:00-12:00
	12:00-13:00	13:00-14:00	14:00-15:00	15:00-16:00	16:00-17:00	17:00-18:00
	18:00-19:00	19:00-20:00	20:00-21:00	21:00-22:00	22:00-23:00	23:00-24:00

LHM 500 SN:140.557	06:00-07:00	07:00-08:00	08:00-09:00	09:00-10:00	10:00-11:00	11:00-12:00
	12:00-13:00	13:00-14:00	14:00-15:00	15:00-16:00	16:00-17:00	17:00-18:00
	18:00-19:00	19:00-20:00	20:00-21:00	21:00-22:00	22:00-23:00	23:00-24:00

Figure 30:Artifact 2

Efficiency in the administrative burden of customers and the port authority

The artifact is designed to decrease the administrative burden on agents, stevedores and the port authority. The artifact makes it possible to store historical data which has been filled in, so that registry data such as vessel characteristics only need to be completed once in the system. Agents do not have to spend time sending emails with rectified information over and over, but rather can complete it themselves in the artifact, and control any changes needed. Similarly, port control does not need to check emails to match the berth request with the crane request, update the ETA or rectify errors which contain easily accessible information. The artifact decreases the need for the crane to have a 'change of location' on the day of operation due to low level of draught that disrupts the planning of both the crane and berth allocation. This decreases the administrative burden of the customers and the port authority, providing additional time to focus on optimising customer service and being competitive in providing services. In addition, the artifact decreases the invoicing procedure from fifteen days to 24 hours by shifting from a physical collection and confirmation process to one which is digital and generates information from the artifact.

Efficiency in long-term planning

The artifact makes it possible for the Port of Esbjerg technical department to be involved with stevedores earlier in the planning, not just on the day of execution. This initiates the conversation of crane allocation priority and the mobile crane driver between different stevedores early in the process (with a contingency plan for vessel delays) rather than on the day the vessel is due to arrive. The crane priority guidelines state that in the case of double booking, the crane is assigned according to the volume and type of cargo. With a denser network, the priority can be established based on the proximity of the vessel and where the mobile cranes are not required to travel long distance between jobs (which results in more idle time and higher fuel costs). Due to the digital nature of the artifact, best practices can be recorded as scenarios for future planning. This transparency increases the levels of positive bargaining power between competitors to share mobile cranes and, simultaneously, builds a long-term relationship based on an unbiased and equal footing.

Efficiency in data transparency

The artifact makes it possible for the Port of Esbjerg to provide data transparency and control to its customers. The artifact has access to transparent information, such as the draught level of a berth, the crane dimensions and types available, and the berth availability at certain days and times. The artifact also provides a trusting environment in which agents and stevedores can control the visibility of the information shared. This debunks the assumptions that competitive and commercially sensitive data will be visible to even their competitors. This creates trust in information sharing and decreases error that would be easily avoidable.

12.2. IMPLICATION FOR STAKEHOLDERS

Direktør Forum 2018

The artifact was communicated at the Danske Havnes Direktør Forum held on 25th October 2018 at Lindø Port in Odense. Directors from the Port of Odense, Port of Køge, Port of Alborg, and Port for Aarhus attended the presentation. The artifact was presented as a detailed demo (Figure 31) to initiate the conversation about digitalisation in Danish ports. The demo presented the artifact as part of a customer dashboard situated within the port's website, where customers could log in to request a crane and berth for their vessel. It was communicated that the customer dashboard was just one example of how we believe the artifact can provide accessibility to our customers, as seen in the snapshot below. The demo showed that when a customer logs into the dashboard, the landing page gives them the option of selecting from the different services offered by the port authority. The options were ship registry (which consists of vessel information), berth booking, crane booking, waste pick up, checking the invoicing, sweeping and a request for water and electricity. When the agent or stevedore clicked on the option, they would be taken to the artifact.

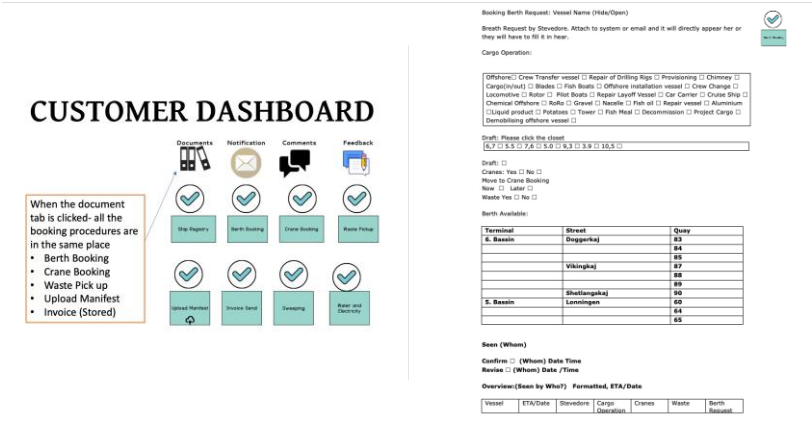


Figure 31:Demo of the Artifact

It was easy to understand what the intention of the artifact was since it focused only on port services rather than customer services. As such, this clarified to the port how they can digitalise, where their boundaries lie, and how it would look. The feedback on the artifact was positive and provided the Port of Aalborg, the Port of Esbjerg and the Danish Port Association with the inspiration to take a step forward with regards to digitalisation.

Danish Shipbrokers Association

The artifact can create an environment where shipbrokers and freight forwarders can share information with the port. The sole focus for the port authority will be to provide optimal services to its customers. The representatives were keener to have the artifact developed and controlled by a neutral party rather than the port authority. Whilst they saw value in the artifact, they were clear about what the governance of the artifact should look like. The port call optimisation artifact is freely accessible to both central and non-central actors. It is hoped that this new digital interaction with port actors who have never previously communicated directly with each other in the network will increase. Given this, port authority governance could easily be replaced by a neutral party.

Havn2000

The artifact was designed to be used by small-to-medium sized ports, with the potential for it be standardised so that it could be adopted by multiple port authorities. Havn2000 is a group of experts who have the responsibility for implementing standardised digital tool for ports. The forum consists of representatives from each of the port authorities. The artifact was presented to the Havn2000 group as an alternative to their current option. Their response was to see the value of the artifact as a simple tool which was not expensive to create or maintain. With regards to governance, they were open to undertaking the development part of the artifact.

12.3. TTHE ARTIFACT’S CONTRIBUTION TO STRUCTURAL EMBEDDEDNESS

In the port literature, design science is still in its infancy. However, this paper shows that the design science framework contains a methodology for studying developments in digitalisation, and can be used for increasing embeddedness in the port network. Moreover, it also provides an opportunity for establishing a thorough but measurable theory, such as network centrality, within the port performance context. This paper limits itself to illustrating how design science can be adapted to the study of efficiency, following what is predominantly a qualitative methodology. The contribution of the artifact to network centrality literature is presented below.

Proposition 1: All else being equal, as the centrality of actors increases, (a) the likelihood of the administrative process and burden of the port authority decreases, and (b) the likelihood of other actors' collaboration increases.

The port call optimisation artifact creates greater information flow in the berth booking process and provides port control and the agent with a single place to check all agent updates. The flow of concentrated information increases the extent of port control's own centrality in the network. Port control's assistant harbour master spends less time updating or searching emails from agents to check the new ETA of the vessel. If there is a change in the vessel name, or the date of the arrival of the vessel is changed by the agent, the harbour master can use this information to revise their berth planning for the week. In this case, the artifact contributes to the overall structural embeddedness of port control in the network by integrating an opportunity for customers to edit, share and control their information in the artifact. This provides transparency concerning the information being shared between two actors, structurally increasing the embeddedness in the network.

From the perspective of the port service provider, agents do not need to book cranes separately. Rather, this can be done at the same time by clicking and filling the 'crane needed' part of the artifact. It is strongly expected that this will decrease the administrative burden on all three actors in that there will be fewer emails and phone calls, whilst simultaneously there will be a greater flow of digital interaction that can be harnessed to improve the operational process of all three actors. The result of this will be an increased number of central actors, ensuring that they have equality of accessibility in terms of key information. In this case, the artifact contributes to connecting structurally autonomous actors to a port's core services to gain access to the correct information and dense knowledge, and to decrease structural holes within the triad (i.e. between the agent, port control and stevedores).

The participation of agents and stevedores will also encourage other embedded port actors such as pilots, linemen, and vessel operators to make their own manual business procedures more digital. They can give their input if they see certain red flags being overlooked by port control or agents, for example that the vessel might not be suitable for a particular berth due to the change on draught in that part of the basin. The frequent use of this artifact by the community combined with positive artifact outputs will encourage more port actors to use it, and to demand something similar for other port service areas. In this case, the artifact contributes to increasing the centrality of the actors to a level that creates a denser network. This improves information availability across the whole port community and will also set an example for those central actors who are inspired to pursue efficiency and collaborate.

Proposition 2: All else being equal, as the involvement of two or more of higher centrality actors in a network increases, (a) the likelihood of competitors' collaborating together increases, and (b) the likelihood of competitors initiating a response or a participation to an action increases.

The port call optimisation artifact makes it possible for agents to see the berth availability as well as which berth may have been reserved by another agent, so long as the agents have allowed this information to be made public. If a desired berth is already reserved, an agent can collaborate with the other agent at an early juncture in order to see whether they can request the berth, or else coordinate with the agent via port control to shift the vessel to another berth when they are idle. In this case the artifact contributes to increasing the structural equivalence of agents to create likeness in behaviours, and to increase collaboration between similar actors in the network. Even though they are competitors, the artifact emphasises the benefits of information access, and the sharing of knowledge is more important than the benefit of being a structurally autonomous actor. The artifact is focused on providing equal and efficient opportunities, on increasing transparency regarding the status of berth availability and the clarity of what is being shared. As such, competitors feel comfortable to initiate participation within the artifact. Moreover, this also initiates a continuous collaboration between agents who regularly book the same quay for their long-term customers (i.e. vessel operators).

Proposition 3: All things being equal, an increase in network density (1) will create a positive increase in the bargaining power of competitors, and (2) will create a positive relationship in the whole network regrading value creation.

The port call optimisation artifact makes it possible for port control to increase their interaction with stevedores and agents in case of a 'change of location for the crane' request. Historically, the stevedores would solve this problem themselves; with the artifact, however, it is possible to discuss a change of location for cranes and to use this insight to understand what impact this would have on the rest of the mobile crane schedule. This means that the artifact decreases the structural autonomy of the stevedores with port control and the technical department, and creates a positive relationship in terms of working together to decrease scenarios where cranes are either idle or not in operation. As stated above, autonomous actors such as agents and stevedores would previously have had high control over the key information (about where the cranes should be moved so that cranes could be used optimally), which resulted in a low-density network for port delivered services. This artifact therefore also focuses on increasing port control's interaction with different stevedores. This increases the density of the network, which increases discussion and the exchange of knowledge, ultimately increasing the bargaining power of the stevedore based on healthy, efficiency-driven competition. Similar to proposition (2), the artifact also proves that in proposition (3), regarding network density, an increase in both port control centrality and structural equivalence is more important than an increase in structural autonomy. In this situation, the artifact contributes to decreasing the structural holes in its network of crane and berth allocation.

13. LIMITATIONS

The paper is limited to the network of berth and crane allocation. The paper focuses on using design science to present an artifact that can translate manual processes into digital processes. The intention of this paper is to demonstrate the processes of digitalisation, mainly how it can digitalise with limited funds and with high value. The paper is limited to the design and communication of the artifact to the port authority and port community. It was realised that there was greater opportunity for diverse data collection and in-depth analysis with regards to framework-based research than if the research was based of measuring quantitative efficiency, as undertaken by previous researchers (Haezendonck *et al.*, 2011; Perez-Labajos and Blanco, 2004; Tongzon and Ganesalingam, 2007; Zheng *et al.*, 2015). Similarly, the research gap in the literature also supports our realisation of the need for qualitative-based research. Even though the port is part of the supply chain, their services are overlooked in the efficiency-themed research. The intention of this paper is to follow the technical implications of the artifact in future research, and to inspire fellow researchers to follow the port service-oriented efficiency research.

Appendix::
King, N., Horrocks, C., & Brooks, J. (2018). Interviews in qualitative research. sage.

BIBLIOGRAPHY

Acosta, M., Coronado, D. and Cerban, M.M. (2007), "Port competitiveness in container traffic from an internal point of view: the experience of the Port of Algeciras Bay", *Maritime Policy & Management*, Vol. 34 No. 5, pp. 501–520.

Avison, D., R, B., M, M. and T, W.-H. (1999), "'IS action research: can we serve two masters?(panel session).'", Proceedings of the 20th international conference on information systems. 1999.

Baskerville, R.L. (1999), "Investigating Information Systems with Action Research", *Communications of the Association for Information Systems*, Vol. 2, available at:https://doi.org/10.17705/1cais.00219.

Bell, E., Bryman, A., Harley, & and B. (2018), *Business Research Methods*, edited by press, O. university, 2008th ed., available at: https://books.google.nl/books?hl=en&lr=&id=J9J2DwAAQBAJ&oi=fnd&pg=PP1&dq=Business+Research+Methods&ots=GMcvgf4QDM&sig=BXzmqtA-QpkQ9nAeS20togUiH9I&redir_esc=y#v=onepage&q=Business%20Research%20Methods&f=false (accessed 5 November 2018).

Bliemel, M.J. (2010), *ENTREPRENEURIAL NETWORKS: A REVIEW, METHODOLOGY AND TYPOLOGY*.

Borgatti, S.P. (2005a), "Centrality and network flow", *Social Networks*, Vol. 27 No. 1, pp. 55–71.

Borgatti, S.P. (2005b), "Centrality and network flow", *Social Networks*, Vol. 27 No. 1, pp. 55–71.

Borgatti, S.P. and Li, X. (2009), "On social network analysis in a supply chain context", *Journal of Supply Chain Management*, Vol. 45 No. 2, pp. 5–22.

Brooks, M.R. and Cullinane, K. (2006), "Chapter 18 Governance Models Defined", *Research in Transportation Economics*, Vol. 17, pp. 405–435.

Brooks, M.R. and Pallis, A.A. (2008), “Assessing port governance models: process and performance components”, *Maritime Policy & Management*, Vol. 35 No. 4, pp. 411–432.

Burt, R.S. (2000), “The Network Structure Of Social Capital”, *Research in Organizational Behavior*, Vol. 22, pp. 345–423.

Chang and Talley. (2019), “Port Competitiveness, Efficiency, and Supply Chains: A Literature Review”, *Transportation Journal*, Vol. 58 No. 1, p. 1.

Duru, O., Galvao, C.B., Mileski, J., Robles, L.T. and Gharehgozli, A. (2020), “Developing a comprehensive approach to port performance assessment”, *The Asian Journal of Shipping and Logistics*, Vol. 36 No. 4, pp. 169–180.

Eden, C. and Huxham, C. (1996), “Action Research for Management Research”, *British Journal of Management*, Vol. 7 No. 1, pp. 75–86.

Eisenhardt, K.M. (1989), “Building theories from case study research”, *Academy of Management Review*, Vol. 14 No. 4, pp. 532–550.

Galaskiewicz, J. (1979), *Exchange Networks*, Vol. 75, SAGE Publications, Incorporated.

Galaskiewicz, J. (2011), “Studying supply chains from a social network perspective”, *Journal of Supply Chain Management*, Vol. 47 No. 1, pp. 4–8.

Ghosh, A., Ranganathan, R. and Rosenkopf, L. (2016), “The impact of context and model choice on the determinants of strategic alliance formation: Evidence from a staged replication study”, *Strategic Management Journal*, Vol. 37 No. 11, pp. 2204–2221.

Gnyawali, D.R. and Madhavan, R. (2001), “Cooperative Networks and Competitive Dynamics: A Structural Embeddedness Perspective”, *The Academy of Management Review*, Vol. 26 No. 3, p. 431.

Gonzalez, G.R., Claro, D.P. and Palmatier, R.W. (2014), “Synergistic Effects of Relationship Managers’ Social Networks on Sales Performance”, *Journal of Marketing*, Vol. 78 No. 1, pp. 76–94.

Granovetter, M. (1985), “Economic Action and Social Structure: The Problem of Embeddedness”, *American Journal of Sociology*, Vol. 91 No. 3, pp. 481–510.

Granovetter, M. (1992), “Economic institutions as social constructions: a framework for analysis”, *Acta Sociologica*, Vol. 35 No. 1, pp. 3–11.

Gulati, R. (1998), “Alliances and networks”, *Strategic Management Journal*, Vol. 19 No. 4, pp. 293–317.

Gulati, R. and Gargiulo, M. (1999), "Where Do Interorganizational Networks Come From?", *American Journal of Sociology*, Vol. 104 No. 5, pp. 1439–1493.

Gulati, R., Nohria, N. and Zaheer, A. (2000), "Strategic networks", *Strategic Management Journal*, pp. 203–215.

Haezendonck, E., Broeck, J. van den and Jans, T. (2011), "Analysing the lobby-effect of port competitiveness' determinants: a stochastic frontier approach", *Journal of Productivity Analysis*, Vol. 36 No. 2, pp. 113–123.

Hales, D.N. and Lam, J.S.L. (2019), "Volume 58.1: Guest Editors' Introduction", *Transportation Journal*, Vol. 58 No. 2, pp. v–vi.

Hevner, A. and Chatterjee, S. (2010), "Design Research in Information Systems, Theory and Practice", *Integrated Series in Information Systems*, pp. 9–22.

Hevner, March, Park and Ram. (2004), "Design Science in Information Systems Research", *MIS Quarterly*, Vol. 28 No. 1, p. 75.

Iurkov, V. and Benito, G.R.G. (2017), "Distance in International Business: Concept, Cost and Value", *Progress in International Business Research*, Vol. 12, pp. 517–538.

Johnson, H. and Styhre, L. (2015), "Increased energy efficiency in short sea shipping through decreased time in port", *Transportation Research Part A: Policy and Practice*, Vol. 71, pp. 167–178.

Lam, J.S.L. and Yap, W.Y. (2006), "A measurement and Comparison of Cost Competitiveness of Container Ports in Southeast Asia", *Transportation*, Vol. 4, pp. 832–14.

Lam, J.S.L. and Yap, W.Y. (2011), "Container port competition and complementarity in supply chain systems: Evidence from the Pearl River Delta", Vol. 13 No. 2, pp. 102–120.

Lirn, T.C., Thanopoulou, H.A., Beynon, M.J. and Beresford, A.K.C. (2004), "An Application of AHP on Transhipment Port Selection: A Global Perspective", *Maritime Economics & Logistics*, Vol. 6 No. 1, pp. 70–91.

Long, Y. and Chen, Y. (2021), "Impact of structural embeddedness on the performance of tourism supply chain integration: a social network perspective", *Annals of Operations Research*, pp. 1–17.

Lorrain, F. and White, H.C. (1971), "Structural equivalence of individuals in social networks", *The Journal of Mathematical Sociology*, Vol. 1 No. 1, pp. 49–80.

March, S.T. and Smith, G.F. (1995), “Design and natural science research on information technology”, *Decision Support Systems*, Vol. 15 No. 4, pp. 251–266.

Martino, M.D. and Morvillo, A. (2008), “Activities, resources and inter-organizational relationships: key factors in port competitiveness”, *Maritime Policy & Management*, Vol. 35 No. 6, pp. 571–589.

Miles, M.B. and Huberman, M.A. (1994), “Qualitative data analysis: An expanded sourcebook”.

Moran, P. (2005), “Structural vs. relational embeddedness: social capital and managerial performance”, *Strategic Management Journal*, Vol. 26 No. 12, pp. 1129–1151.

Nahapiet, J. and Ghoshal, S. (1998), “Social Capital, Intellectual Capital, and the Organizational Advantage”, *Academy of Management Review*, Vol. 23 No. 2, pp. 242–266.

Notteboom, T., Langen, P.D. and Jacobs, W. (2013), “Institutional plasticity and path dependence in seaports: interactions between institutions, port governance reforms and port authority routines”, *Journal of Transport Geography*, Vol. 27 No. C, pp. 26–35.

Notteboom, T.E. and Winkelmans, W. (2001), “Reassessing Public Sector Involvement in European Seaports”, *International Journal of Maritime Economics*, Vol. 3 No. 2, pp. 242–259.

Orlikowski, W.J. and Iacono, C.S. (2001), “Research Commentary: Desperately Seeking the ‘IT’ in IT Research—A Call to Theorizing the IT Artifact”, *Information Systems Research*, Vol. 12 No. 2, pp. 121–134.

Peffers, K., Tuunanen, T., Rothenberger, M.A. and Chatterjee, S. (2007), “A Design Science Research Methodology for Information Systems Research”, *Journal of Management Information Systems*, Vol. 24 No. 3, pp. 45–77.

Perez-Labajos, C. and Blanco, B. (2004), “Competitive policies for commercial sea ports in the EU”, *Marine Policy*, Vol. 28 No. 6, pp. 553–556.

Rogers, E.M. (1964), “Diffusion of Innovations”, *Revue Française de Sociologie*, Vol. 5 No. 2, p. 216.

Rowley, J. (2002), “Using case studies in research”, *Management Research News*, Vol. 25 No. 1, pp. 16–27.

Rowley, T., Behrens, D. and Krackhardt, D. (2000), “REDUNDANT GOVERNANCE STRUCTURES: AN ANALYSIS OF STRUCTURAL AND RELATIONAL EMBEDDEDNESS IN THE STEEL AND SEMICONDUCTOR INDUSTRIES”, pp. 1–18.

Song, D.-W. and Panayides, P.M. (2008), "Global supply chain and port/terminal: integration and competitiveness", *Maritime Policy & Management*, Vol. 35 No. 1, pp. 73–87.

Talley, W.K. (2013), "Maritime transportation research: topics and methodologies", *Maritime Policy & Management*, Vol. 40 No. 7, pp. 709–725.

Talley, W.K. and Ng, M. (2013), "Maritime transport chain choice by carriers, ports and shippers", *Intern. Journal of Production Economics*, Vol. 142 No. 2, pp. 311–316.

Talley, W.K. and Ng, M. (2022), "Cargo port choice equilibrium: The case of shipping lines and cargo port service providers", *Transportation Research Part E: Logistics and Transportation Review*, Vol. 164, p. 102817.

Talley, W.K., Ng, M. and Marsillac, E. (2014), "Port service chains and port performance evaluation", *Transportation Research Part E*, Vol. 69 No. C, pp. 236–247.

Thomas, G. (2011), "A Typology for the Case Study in Social Science Following a Review of Definition, Discourse, and Structure", *Qualitative Inquiry*, Vol. 17 No. 6, pp. 511–521.

Tongzon, J. and Heng, W. (2005), "Port privatization, efficiency and competitiveness: Some empirical evidence from container ports (terminals)", *Transportation Research Part A: Policy and Practice*, Vol. 39 No. 5, pp. 405–424.

Tongzon, J.L. and Ganesalingam, S. (2007), "An Evaluation of ASEAN Port Performance and Efficiency*", *Asian Economic Journal*, Vol. 8 No. 3, pp. 317–330.

University, T.A.N., Gregor, S., Hevner, A.R. and Florida, U. of S. (2013), "Positioning and Presenting Design Science Research for Maximum Impact", *MIS Quarterly*, Vol. 37 No. 2, pp. 337–355.

Valente, T.W. (2003), "Diffusion of innovations", *Genetics in Medicine*, Vol. 5 No. 2, p. 69.

Verhoeven, P. (2010), "A review of port authority functions: towards a renaissance?", *Maritime Policy & Management*, Vol. 37 No. 3, pp. 247–270.

Wanke, P.F., Barbastefano, R.G. and Hijjar, M.F. (2011), "Determinants of Efficiency at Major Brazilian Port Terminals", *Transport Reviews*, Vol. 31 No. 5, pp. 653–677.

Wasserman, S. and Faust, K. (1994), "Social network analysis: Methods and applications".

Yang, H., Lin, Z.J. and Peng, M.W. (2011), "Behind acquisitions of alliance partners: exploratory learning and network embeddedness", Vol. 54 No. 5, pp. 1069–1080.

Yin. (2003), “Case Study Research Design and Methods.”, *3rd Edition, Sage, Thousand Oaks.*, available at: https://www.scirp.org/(S(lz5mqp453edsnp55rrgjct55))/reference/ReferencesPapers.aspx?ReferenceID=1994558 (accessed 18 September 2021).

Yin, R.K. (2009), “Case study research: Design and methods (applied social research methods)”, *London and Singapore: Sage*.

Yuen, A.C., Zhang, A. and Cheung, W. (2013), “Foreign participation and competition: A way to improve the container port efficiency in China?”, *Transportation Research Part A*, Vol. 49 No. C, pp. 220–231.

Zheng, S., Yin, C., Zheng, S. and Yin, C. (2015), “Technical, allocative and cost efficiencies of Chinese ports”, *Maritime Policy & Management*, Vol. 42 No. 8, pp. 746–758.

CONTRIBUTION OF THE THESIS

This chapter provides the final contribution of the thesis Port Business Development: Digitalization of Port Authority and Hybrid Governance Model. The contribution chapter aims to explain of the contribution of the three-paper titled as follows: -

a) Entrepreneurial Zealousness in coopetition port authority strategy: Opportunity recognition Framework
b) Go Paperless and its impact on Port Governance: An Exploratory case study of Danish Port Authority
c) Application of Digitalisation in landlord port to achieve efficiency in port performance: Longitudinal study

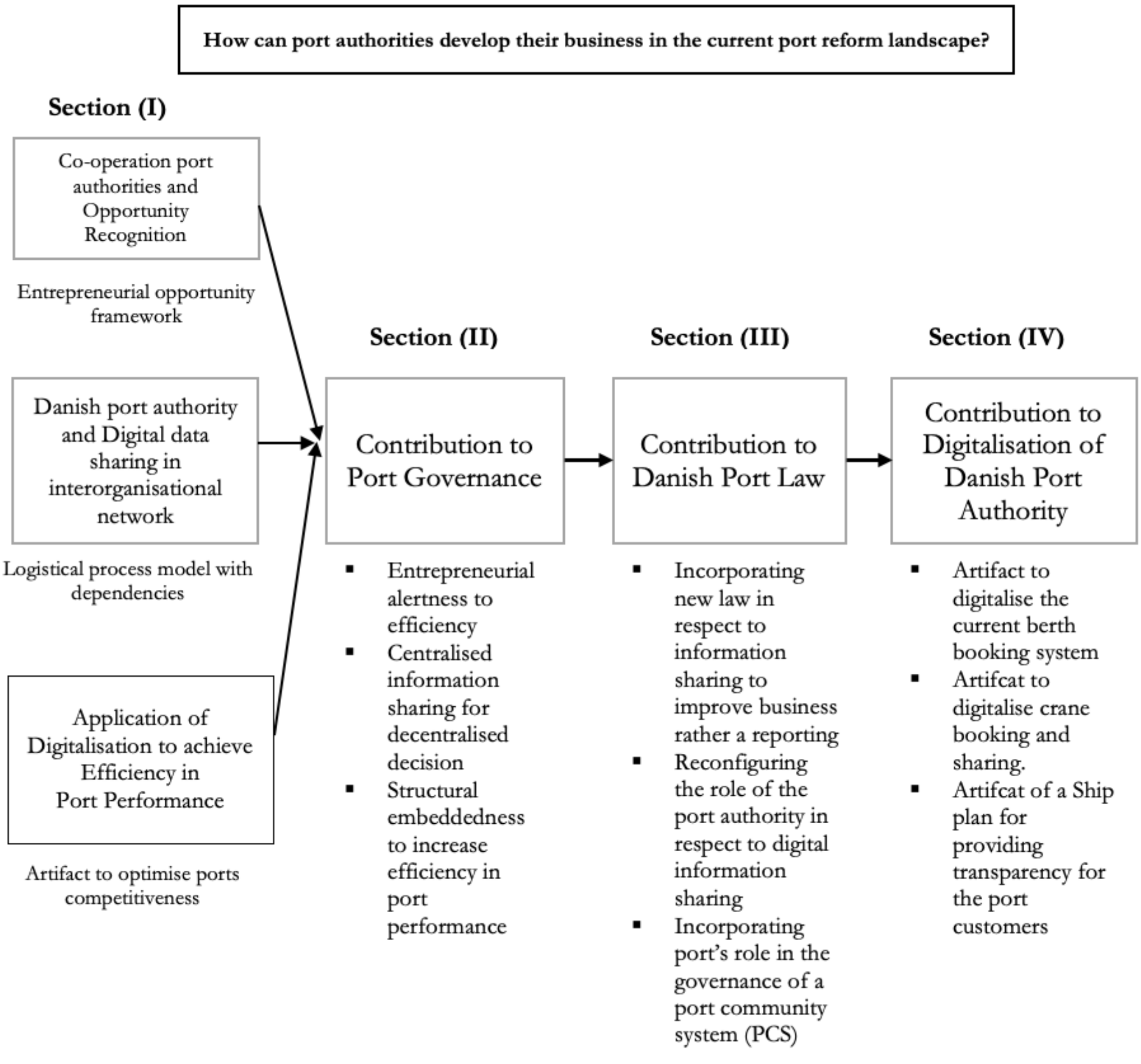


Figure 32: Overview of the Paper Contribution

The chapter is divided into four different parts: -

I. The chapter discusses the contribution of each paper to the overall question of 'How can port authorities develop their business in the current port reform landscape? 'This section 1 presents an a) Entrepreneurial opportunity framework, b) Logistical process model with dependencies c) Artifact to optimise ports competitiveness.
II. The chapter contributes the theoretical contribution of Hybrid Port Governance by presenting, a) Configuration 1 – Port digitalisation and its impact on port governance and b) Configuration 2 -Port Community digitalisation to improve port business.
III. This Chapter presents the contribution for Danish Port Reform, by suggesting recommendation to Danish Havneloven (Danish Port Law, 1999) in respect to information sharing legislation, development of digital platform and port community system.
IV. This chapter presents two solutions for the Danish port authority and Danish port community. a) Process focused customer dashboard for digitalising Berth allocation and Crane allocation and b) Customer focused Port Call optimisation dashboard owned by a neutral party to increase information sharing among the port community

1.CONTRIBUTION OF THE THREE PAPERS

CONTRIBUTION ONE
CO-OPERATION PORT AUTHORITIES AND OPPORTUNITY RECOGNITION

The first contribution of this thesis is to the revisit version of the conceptual model introduced in opportunity theory, drawing on Schumpeter (1934) and Kirzner (1973) as foundations. The opportunity recognition framework is an input-process-output model. In respect of contribution to research, this framework aims to provide a new stream of opportunity recognition studies in the context coopetition ports authorities research (Wang & Mileski, 2018). This thesis contributes the concepts framework to be further investigated in the discipline of port authority cognition to develop entrepreneurial strategies (Lugt et al., 2017)

1.1. INCREASE PORT COMPITATIVENESS

In respect of research question, it is argued that to develop new business coopetition port authorities have to show more alertness towards entrepreneurial strategies. To accomplish this, the antecedents of alertness need to be investigated in order to recognise opportunities that could be turned into business-like strategies. This paper focused on the strategies of coopetition port authorities because they have the advantage of being innovative, coopetition ports which have accessibility to more than one port in close proximity or in different location. Coopetition ports are also more likely to recognise entrepreneurial opportunity because of their preponderance to employ top executives with business and commercial experience. They also have the advantage of legally being able to recognise a business-like strategy because of the ownership structure of public limited liability ports.

1.2. THE CONCEPTUAL FRAMEWORK

In summary, this thesis presents the term entrepreneurial zealousness to encompass the traits of entrepreneurial alertness as well as the creativity of the personality and the inquisitiveness of experiencing newness in the quest to recognise opportunity. This thesis states that the existence of entrepreneurial zealousness is essential for the successful outcome of recognising new opportunities. To evade an outcome like value void, it is essential to invest time in nurturing the antecedents of entrepreneurial zealousness, interpersonal trust, and autonomy. This thesis argues that the higher the existence of these antecedents, the greater to the contribution to a wide selection of business-like opportunities.

The framework focuses on the antecedents that existed only in the port authority, and studied the interaction and implication of the business-like opportunities for port users and port associations. The outcome is divided into value sought, value captured, value void, and new opportunity. Value is captured when an established opportunity reaches a positive outcome. If the outcome creates new insights which provide a new form of business idea, then the outcome achieved is a 'new opportunity'. Similarly, if a new form of opportunity is pursued by entrepreneurial zealousness, then the outcome achieved is known as 'value sought'. Lastly, 'value void' is the outcome achieved when there is an absence of antecedents. In the section below we discuss the contribution to each variable of opportunity recognition, and further discuss their contribution to each outcome.

- *Entrepreneurial alertness*
  The main antecedents of Entrepreneurial alertness are Entrepreneurial zealousness, Openness to experience synergy and adaptive mental framework. The antecedent of entrepreneurial zealousness as "the ability to enquire about new areas with openness to experiences" even though disadvantage and limited knowledge may be present. Entrepreneurial zealousness can assist port authorities recognise

> *"The paper presents the antecedent of synergy that explains "the ability to avoid duplication and use an idea, resource, or an advantage to its full capacity". In this paper, the antecedent of synergy is used to optimise the newly-merged port authority to avoid duplication of strategy and to avoid preventable competition. In addition, the paper contributes adaptive mental framework as an antecedent as the ability to 'think outside the box'. This paper states that adaptive mental framework encourages individuals – or in our case port authorities – to be unique, initiative, and inventive with recognising opportunities"*
>
> *Short Summary of Contribution of Entrepreneurial Alertness*

- *Prior knowledge*
  The main antecedents of Prior knowledge are deliberate searching, accesses to knowledge and scanning for information. In coopetition port context, 'we translate prior knowledge as a cognitive

function of translating and storing information that is used to recognise opportunity. It refers the whole knowledge base of a individual's past.'

> *"The paper investigates antecedents as bundles of attributes that represent prior knowledge. In this paper, we contribute the antecedent of deliberate searching, access to knowledge and scanning for information. These antecedents achieve the outcome of value sought and new opportunity. The antecedent of deliberate scanning provides port authorities with insights into markets that had not previously been considered for business or potential customers. Similarly, industry-specific 'access to knowledge' provides an advantage in connecting to the right port user in the network."*
>
> *Short Summary of Contribution of Prior Knowledge*

- *Network Ties*

  The main antecedents of Network Ties are Interpersonal Trust and autonomy. In coopetition port context, the network ties are defined as 'business relationships or connections between different network actors from different firms.

> *"In the port authority context, most of the information is held by the agents, hence making them a powerful entity in the network. It is crucial that there is a high level of interpersonal trust with agents so that the port authority can optimally use their new form of governance structure. If there is an absence of interpersonal trust, this will create mistrust amongst the agents. This can result in the port authority decreasing the information accessibility within the network, eventually contributing to value void. Autonomy is an antecedent that provides the port authority with optimal use of the new governance structure."*
>
> *Short Summary of Contribution of Network Ties*

- *Personality traits*

  In coopetition port context, the personality trait is defined as 'ability of an individual or a firm to strive for change even though the environment it exists in is constant".

> *"This paper takes personality traits into consideration to study the cognitive process through which port authorities recognise opportunity. In this paper, we contribute the antecedent of change mentality, mindfulness of learning and self-correction. The attribute of 'change mentality' is explained as the 'ability of an individual or a firm to strive for change even though the environment it exists in is constant'. Moreover, change mentality means that individuals and firms are ready for any new development, and strive for the best possible outcome. Similarly, this paper presents the antecedent of mindfulness of learning as the 'ability of an individual or a firm to be aware of the impact the changes have on the internal employees, business environment and other externalities."*
>
> *Short Summary of Contribution of Personality Traits*

This conceptual framework contributes to identifying the business- like opportunity that eventually contribute to port competitiveness. The antecedents of prior knowledge, entrepreneurial zealousness and network ties combine, will provide enough insight and market information for the port authority to create coopetition strategies that eventually (we argue) will contribute to port attractiveness and competitiveness. These antecedents will also provide necessary insights in creating higher network density and higher network centrality. Moreover, entrepreneurial opportunity framework can we used to increase collaboration in the interorganisational network.

To summarise, this thesis contributes the entrepreneurial opportunity recognition framework with the intention to increase network connectivity, increase coopetition strategy and simultaneously contribute to the strategy of digitalisation of the port community.

2. CONTRIBUTION TWO

DANISH PORT AUTHORITY AND DIGITAL DATA SHARING IN INTERORGANISATIONAL NETWORK

This thesis contributes the logistical process model (LPM) that can be used by small-to-medium-sized port authorities to map their digital resource sharing and dependencies within their port community. The LPM is generic enough to map a port that handles different types of cargo, and which are dependent on digital resources from a range of port actors. The LPM is divided into different components, namely commercial, ordering, operational and financial. The LPM analyses shippers, agents (or forwarders), carriers, the port community system, terminals, inland operators, port authorities, nautical services, port services and, finally, consignees. The model illustrates the presence of each actor within the port logistic model. The aims of this LPM is to contribute to understanding the boundaries of part authority and the port community in the quest of digitalising their administration processes. In this thesis, a port logistical model is used to map the digital resources shared by each actor in the logistical process.

2.1. INCREASE DIGITAL RESOURCE SHARING

To summarise the logistical process model is used to map the limitation of the digital resource sharing for Danish port authorities. The current ambition of the port authorities was to build a business optimisation platform, such as a berth allocation, crane booking and automatic invoice generator. The dilemma was that the port actors were owners of most of the resources which the port authorities required to create a research digital resource sharing platform. Moreover, the port authorities of Aalborg, Aarhus, ADP and Esbjerg were creating their platforms in isolation, and had different levels of technological advancement. The consequence of this was a greater administrative burden for customers to provide information into each system. This paper investigates the characteristics needed for successful implementation of a resource sharing platform which requires collaboration from port actors (e.g. stevedores, agents, and vessel operators) but which is underpinned by a philosophy that a standardised customer-focused resource sharing platform is desirable. This thesis concluded that resource sharing exchange should be built on trust based interaction, customer value and formal contract agreement. Regarding the issue of trust, when exchanging digital resources, both port users and port service providers should have total control as to who gets access to the whole platform. Regarding the issue of contract based agreement, the exchange should be based on contracts which state the intention of use of the digital resources, the number of years this information will be stored for, and if used for insights who it would be shared with. Finally, regarding customer value, the Danish ports' aim should be a neutral and transparent 'one single truth' approach (one place, one platform) for the whole logistics process model.

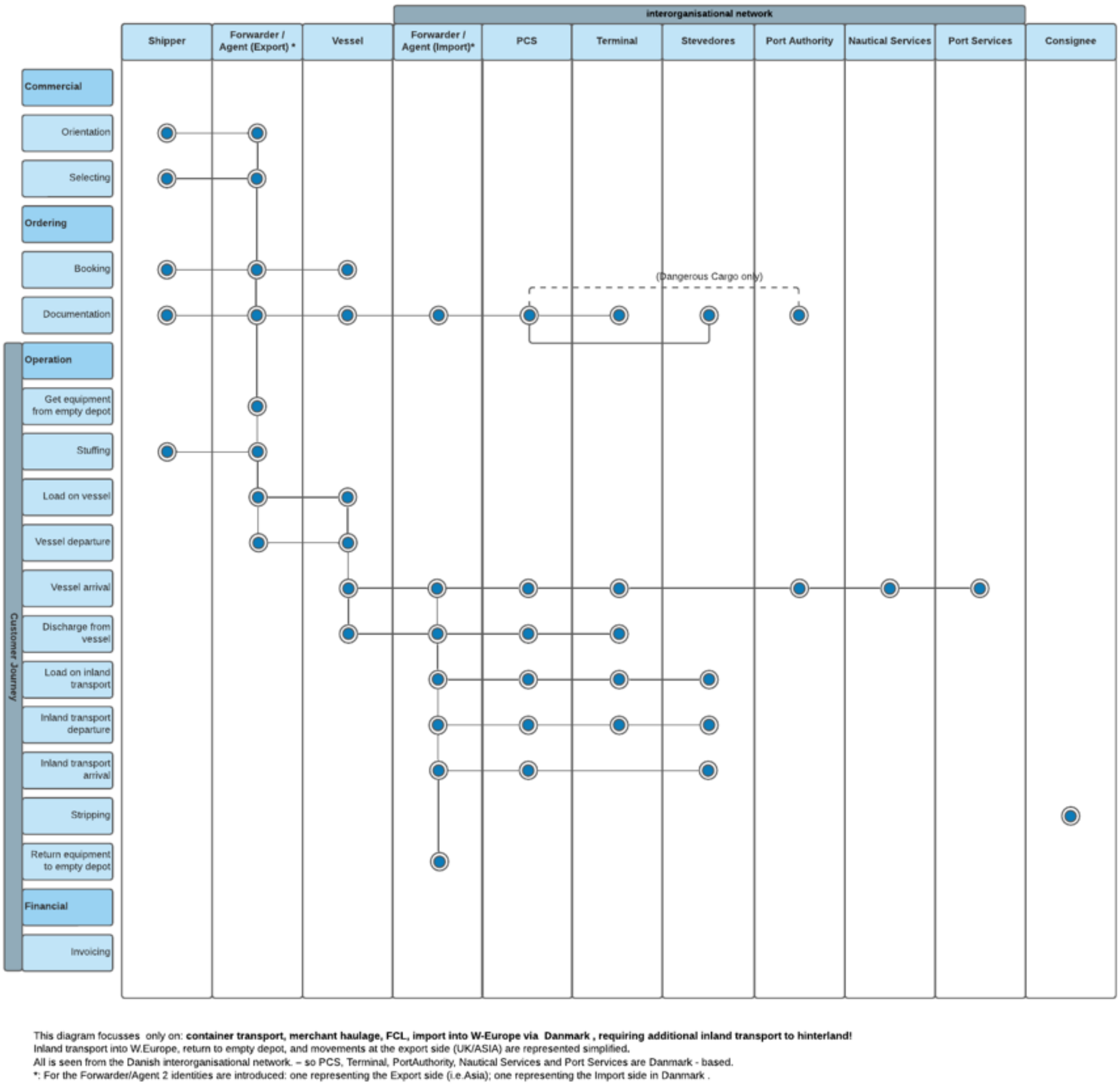


Figure 33: Logistical Process Model

2.2.THE LOGISTICAL PROCESS MODEL

This LPM provides insight into the roles played by each actor in the port community system. This LPM can be used to map the digital resources shared, it can be mapped to highlight an actor's role, and it can be used by the port community to divide the role of digitalisation between the port community and the port authority. The LPM is divided into different components, namely commercial, ordering, operational and financial. The LPM analyses shippers, agents (or forwarders), carriers, the port community system, terminals, inland operators, port authorities, nautical services, port services and, finally, consignees. The model illustrates the presence of each actor within the port logistic model. In this paper, a port logistical model is used to map the digital resources shared by each actor in the logistical process.

- *Commercial*

  The commercial step of the logistical process model can provide port authority with insights on the development needed in the ordering and operational steps of the logistical process model. With the antecedents of entrepreneurial zealousness, the port authority can value sought the strategy need to build strong relationships with shipper and agents. This step of the LPM contributes to the possibility of future coopetition strategy that increase the port competitiveness.

> *Description of commercial as explained by paper 2*
>
> *'The commercial step of the LPM consists of 'orientation' and 'selection'. Orientation is where the shipper asks for a quotation for transporting cargo by sea from various agents and stevedores. The selection process begins with the shipper (cargo owner) receiving all the necessary quotes, scheduling and customer service offered by the agent. Based on this, the cargo owner selects the agent to represent the cargo"*

- *Ordering*

  The ordering step of the logistical process model can provide the whole port interorganisational network the insight to optimise their administrative processes. Most of the pre-arrival notification and preparation of documents occur in this stage. Documentation has the high level of administration burden and it's the optimal step to digitalise in the network.

> *Description of Ordering as explained by paper 2*
> *"The ordering step of the LPM consists of 'booking' and 'documentation'. 'Booking' is a procedure where a carrier is contacted by the agent (representing a cargo owner or shipper) to book a spot in the vessel to transport goods from one port to another. The documentation step consists of preparing the document for the pre-arrival notification of the vessel. The agent has to coordinate the documentation process with the import agent, the cargo owner, the carrier, the port community system, and the port authority. An agent also has to coordinate the documentation with the inland operator."*

- *Operational*

The Operational step of the logistical process model provides insight on the intraorganizational embeddedness of the network. This step provides operational clarify to the documentation steps. These two steps consist of factors that decide the port competitiveness as well as attractiveness.

Description of Operational as explained by paper 2
"There are 11 operational steps in the logistical process. The first operational step is when the agent books 'equipment from the empty depot', where the cargo will be contained during transportation. After this, the agents collect the cargo from the shipper and implement the process of 'stuffing' the cargo into the packaging (e.g. containers, pellets, or temperature-controlled barrels). Once the cargo is ready to transport, the agent 'loads the cargo on the vessel'. When all the cargo is loaded, the 'vessel is ready for departure'. The departure of the vessel is communicated to the agent by the carrier. The 'vessel arrives at the destination', where the import agent is ready to receive the cargo. The vessel arrival procedure consists of the port authority providing the berth and either the terminal or stevedores ready to 'discharge the cargo'. The inland operator stands ready to load the cargo for 'inland transport'. The 'inland transport' arrives at the destination of the cargo. This is communicated between the agent (import) and the port community system. Finally, the cargo is 'stripped' by the agent, and the 'equipment is delivered to the depot' for future use"

- *Financial*

The financial step of the logistical process model provides insight for the invoicing process. It also provides insights on the number of vessels visited the time of their stay and what operations were undertaken by those vessels.

Description of Financial as explained by paper 2
"The final step of the logistical process model is invoicing. With regards to port authorities, ship dues and cargo dues are invoiced to the carrier. With regards to agents and stevedores, the commission is invoiced to the cargo owner. With regards to vessels, carrier and shipping line charges are invoiced to the cargo owner or agent. With regards to modalities, shipment charges are directed to the agent and cargo owner"

3. CONTRIBUTION THREE

APPLICATION OF DIGITALISATION TO ACHIEVE EFFICIENCY IN PORT PERFORMANCE

The third stream of research coalesced the first and the second in order to test out the theory that the entrepreneurial digital resource sharing platform strategy would create the opportunity to share more information in a trustful, neutral and transparent form of one single truth. This would create greater information flow within the port actors' central network, increase the collaboration between non-central and central port actors, and create a denser network. To accomplish this, an berth and crane booking system artifact was designed and tested in three of the Danish ports, for generalisation and reliability. The consensus of both the port authority and the port actors was that this artifact would have several benefits, namely: decreasing the administrative burden; increasing participation with the port central network, both central and non-central; increasing the bargaining power of the competitors; increasing participation between various central actors to reach a balanced network centrality; and increasing the number of central actors.

3.1.HIGHER NETWORK DENSITY

Using network centrality as a starting point, the thesis contributes two artifacts that contribute to three areas, namely increasing the centrality of actors, increasing the collaboration between competitors, and creating a denser network. Due to the digital nature of the artifact, best practices can be recorded as scenarios for future planning. This transparency increases the levels of positive bargaining power between competitors to share mobile cranes and, simultaneously, builds a long-term relationship based on an unbiased and equal footing. The artifact also provides a trusting environment in which agents and stevedores can control the visibility of the information shared. This debunks the assumptions that competitive and commercially sensitive data will be visible to even their competitors. This creates trust in information sharing and decreases error that would be easily avoidable.

3.2 ARTIFACT ONE AND TWO

Berth allocation artifact

The Berth allocation presents the port authority with the opportunity to contribute to the overall port competitiveness. Simultaneously, it provides a means through which port authorities can communication and collaborate with the port community. The berth allocation artifact will provide an example of how digitalisation can optimise an interorganisational administrative process. This can set precedence for more future digital initiatives.

Summary of Berth Allocation from paper 3

Berth allocation is described as a procedure for allocating a specific berth location to a vessel on a specific day at a specific time so that its cargo can be loaded or unloaded, and so that the crew can be changed. Berth allocation is a part of the port call optimisation service of the port authority. The main actors in the berth allocation process are agents, the vessel captain, stevedores, and port control.

Carne allocation artifact

The crane allocation similar to berth allocation, presents the port authority with the opportunity to contribute to the overall port competitiveness. Simultaneously, it provides a means through which port authorities can communication and collaborate with port community on both administrative level as well as operational level. The crane allocation artifact will provide an example of how digitalisation can optimise a sharing of infrastructure among the stevedores. This can set precedence for more collaborative projects.

Summary of Crane Allocation from paper 3
The port's authority provides stevedores with mobile cranes for performing specific loading and unloading operations. To book a mobile crane, agents must provide information 24 hours prior to when it is required. Agents book the cranes with information about the vessel name, type of cargo and the relevant times. This information contributes to the efficiency of port control's berth planning, crane schedule, and ship and crane dues. Similarly, the mobile cranes provide stevedores with the assets to perform their operations on the quayside.

The thesis aims for the artifcat to increase collaboration in the interorganisational network. The artifcat provides the port authority to optimise their core processes defined under the legislation of the Port law. The artifacts convert the information to digital resource sharing, therefore increasing interaction between different port actors. This also increases the exchange of knowledge, ultimately increasing the bargaining power of the stevedore based on healthy, efficiency-driven competition. Therefore, ultimately increasing the port competitiveness. In addition, the higher network density is archived in the port interorganisational network Creating possibility of future collaboration, interaction and even a collaborative digital initiative. To summarise, these simple artifcat start a conversation of neutrality and digital resource sharing in the port community.

4. THEORETICAL CONTRIBUTION: HYBRID PORT GOVERNANCE

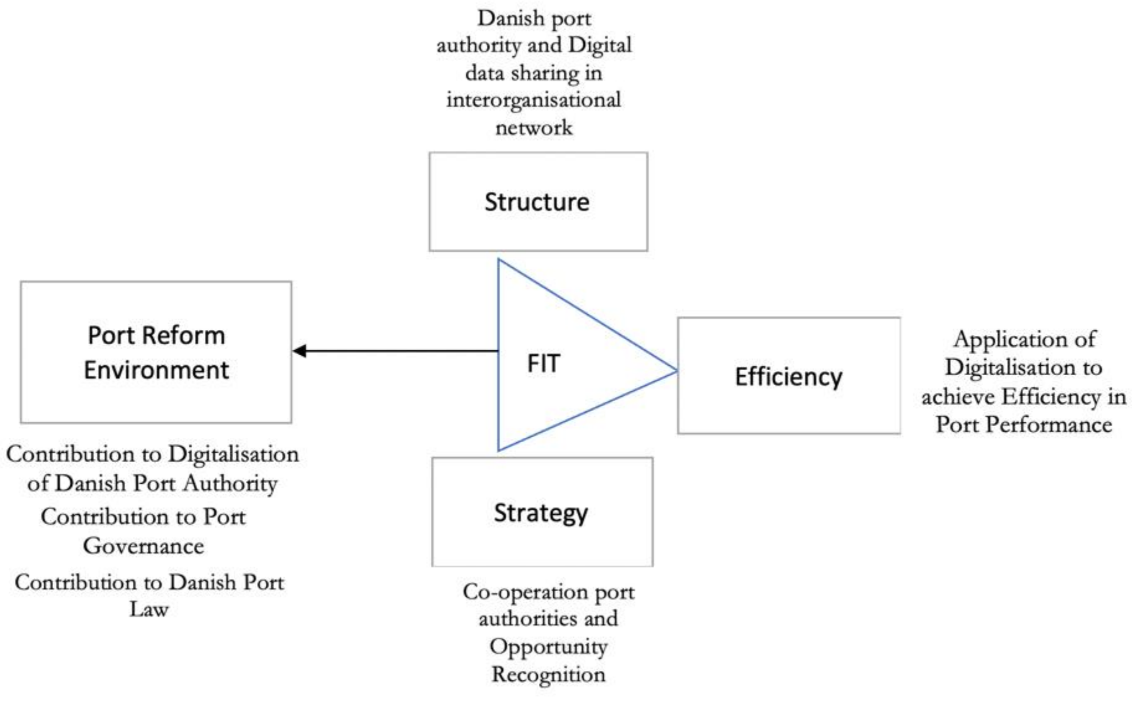


Figure 34:Adopted Model

The overall purpose of this section is to contribute to the theoretical foundation of the governance model as stated in the section (8) of the CAPE(Synthesis of the Three Paper) and Figure (34). It hopes to provide sufficient support to enquire into this phenomenon of entrepreneurial alertness and network density which has historically been overlooked by this stream of literature. The first contribution lies in the strategy element of the governance model. This thesis investigated the entrepreneurial alertness (Kirzner, 1973) within the context of cooperation port authority strategy; the specific focus of the investigation was the antecedent of entrepreneurial alertness. It discovered that there is another translation of 'alertness' that fits perfectly to cooperation port authorities, namely that it can be used to describe entrepreneurs' motivated propensity (Kirzner 1985: 56). Entrepreneurial zealousness, however, goes beyond motivation or uncertainty (Korsgaard et al., 2016), and provides an awareness of entrepreneurial opportunity of business-like strategy while still embodying the non-entrepreneurial environment of a port authority. For cooperation ports, entrepreneurial zealousness is a perfect antecedent to embody as it provides the opportunity for them to create a business-like strategy whilst simultaneously existing in their government-regulated environment. Therefore, this thesis as shown in the Table (35) contributes configuration 1 that when entrepreneurial behaviour is considered within the context of the port governance model, the antecedents of entrepreneurial zealousness provide an opportunity for creating a business-like strategy. Configuration 2 of the thesis also concludes that the absence of antecedents of entrepreneurial zealousness, credibility and leadership in strategy are the main catalyst for value void rather than value creation. Similarly, the thesis focused on increasing the network centrality of the port authority network by creating an artifact that contributes to the strengthening of their network in order to gain a stronger strategic position. This artifact highlighted the fact that it is crucial that port authorities know which port actors in their structure are most essential for their survival. In addition, this also highlights the meticulous relations built by the structure to share the most essential and "non-redundant" information so that the strategic position can be maintained (Yang et al., 2011). This enables the port authority to understand where to build collaborative projects or where to develop digitality in order to create a dense network. Therefore, this thesis contributes configuration 1 (inclusivity of structure embeddedness to increase efficiency in port performance) and configuration 2 (possibility that the model consists of neutral actors in the structure) to highlight the port actor's relevance with the port authority within the literature of network centrality. Finally, the thesis contributes the limitations experienced by this thesis with the port governance model. For example, configuration 1 lacks regulation for ports to cooperate with customers on digital services and functions, while configuration 2 lacks regulation on the new port role with regards to digitalisation and new governance. To conclude on our theoretical contribution towards the port governance model, it is proposed that the governance should be transitioned to encompass the digital nature of the port authority. Our recommendation is a hybrid governance model that provides configuration 1 for the environment (centralised information sharing for decentralised decisions and configuration) and configuration 2 (defined roles for governing data-related service for customers, ports and governing bodies based on trust, transparency, and monitoring).

Table 15: Contribution to Governance model

Governance Model Element	Configuration 1 (Port Digitalisation)	Configuration 2 (PCS)
Strategy	Creation of entrepreneurial business-like strategies	Autonomy and trust, credibility and leadership and entrepreneurial zealousness lead to a more proactive role of the port that challenges port reform.
Environment *Current*	Lacks regulation for ports to cooperate with customers on digital services and functions	Lacks regulation on new port role with regards to digitalisation and new governance
Intention	Centralised information sharing for decentralised decisions	Defined roles for governing data-related services for customers, ports and governing bodies based on trust, transparency, and monitoring
Structure	Inclusivity of structure embeddedness to increase efficiency in port performance	Possibility for the model structure to consist of a neutral actor

Figure 35: Theoretical Contribution : Hybrid Port Governance

Using these four 'value' concepts of entrepreneurial zealousness, alertness in strategy, characteristics for implementation (e.g. centralised information sharing for decentralised decisions) and network centrality to increase efficiency in port performance, this thesis puts forward the argument that a new generation of port authorities is being constructed. The chief characteristics of these authorities is that whilst they function as a commercialised port, they remain conservative in terms of the market and technology. As such, this brings us back to the overall research question, namely how port authorities can develop their entrepreneurial business in their current port governance? This thesis realises that the study of value is important not only for the business development of port authorities, but also for other aspects of the governance model. The development of the port as a business has provided the opportunity to start a new stream of research to understand 'value' in a hybrid governance model.

5. EMPIRICAL CONTRIBUTION : CONTRIBUTION TO THE DANISH PORT GOVERNANCE AND DANISH PORT LAW (HAVNELOVEN)

The current port reform regulation in Nordic countries is changing in several ways. In 2000, the Danish port law was reformed, with their old commercial harbour law transforming into a new port law. The purpose of this law was to provide small and medium-sized ports with the opportunity to reconstruct and reconfigure themselves to attract more business with a wider range of customers. This opportunity also created a novel surge in employees with commercial and entrepreneurial backgrounds being hired for top management positions.
The Port Law divided port ownership into the following types:

- municipal port;
- self-governed municipal port;
- private limited company owned fully or partly by a municipality; or
- private limited company.

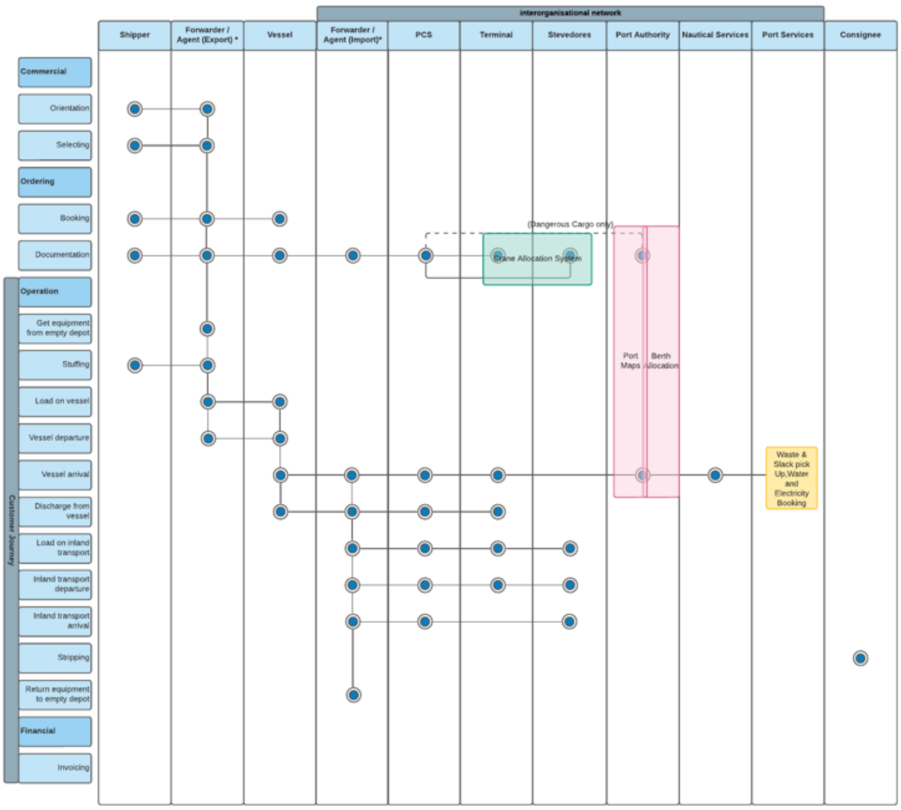
In Denmark there are presently seven ports under public limited liability ownership, namely: Associated Ports; Copenhagen Malmo Port; AB, Port of Grenaa; Nexø harbour; Odense harbour; Port of Aalborg; and Rønne harbour. The rest of the ports, such as Aarhus Harbour, Port of Esbjerg, Frederikshavn Harbour and 19 other ports, are municipal self-government ports, meaning that they are restricted from participating in any entrepreneurial business opportunities. The Danish Regulation in Port Law (Havneloven) states that although ports which have reformed as public limited liability ports can participate in entrepreneurial business opportunities, they must first be advertised to private enterprises through a tender in the newspaper, and only if there are no interested parties to implement this opportunity can the port itself develop the business. Although digital platforms are not specifically mentioned as services, lobbyists representing customers such as the Danish Ship Brokers Association and the Danish Freight Forwarder Association assume that digital services are also excluded from port responsibility, per the port law. The only digital project which they can undertake is the transformation of paper-based administrative forms into digital forms per the single window reporting procedure. However, this creates a hurdle for the digital transformation of Danish Port Authorities. As reported in the three-research stream of entrepreneurial zealousness, resource sharing neutrality and the artifact to digitalise the current berth booking system, it is clear that port authorities can digitalise in a way that contributes to their customer value (i.e. decrease in administration burden), optimises the port call (i.e. berth and crane allocation) and increases collaboration between port authorities and different customer based on trust, transparency and neutrality. This can be achieved through an artifact which digitalises crane booking and sharing, and an artifact of a ship plan for providing transparency for port customers. Therefore, this thesis provides the following recommendation to the expert committee established by the Danish Ministry of Transport.

STATE DEVELOPMENT POLICY

The Danish Ministry of Transport developed a policy for the development of the port sector. This policy stated that the port sector as a whole should provide solutions which could meet market demands for cargo transportation. It stated that the port sector should be able to compete internationally and, and most importantly, there should be a well-developed 'system of centres of transport' and infrastructure. In addition, the state policy also noted that the port sector should contribute to green transportation initiatives.

RECOMMENDATION ONE: CONSIDERATION OF DIGITAL INFORMATION SHARING IN DANISH PORT LAW

Table 16: Recommendation to Port Authroity



To increase the flow of cargo, Danish ports should invest in digital platforms that provide insights into optimising their infrastructure, in digitalising their infrastructure with sensors, and in monitoring and predictor tools.

> *Conclusion form paper 3 : Digital resource sharing*
>
> *All Danish port authorities should invest in digital resource exchange to optimise berth allocation, crane allocation, providing port infrastructure insights (e.g. port maps), and other port services. For instance, the port authorities in Denmark have already started investing in digitalisation projects such as a digital berth request and digital crane booking system.*

Port authorities should view success in commercial terms, but in terms of efficiency. Specifically, they should recognise bottlenecks and provide solutions concerning data sharing to increase efficiency. This thesis has provided two artifacts, berth allocation and crane allocation booking systems, that can achieve efficiency in terms of the flow of cargo and also provide accessibility to infrastructure. This digital platform will focus predominantly on providing digital resource sharing opportunities up to the boundaries of port infrastructure, as stated in the port regulations for municipally self-governed ports such as Esbjerg, Køge and Aalborg. Municipally owned limited companies such as ADP Port do have an edge, possessing an advantage over business enterprises since port regulations state that they can support and provide services for port users if there is no private actor ready to undertake the opportunity. Under the Statutory Order on Standard Regulations for the Observance of Good Order in Danish Commercial Ports, port authorities are responsible for providing berths to vessels when notified, within a 24-hour period (under section 1(2) of *Notification* and section 3(3) of *Berth*). Section 1 (2) states that port authorities require the ship data, expected time of arrival, expected time of stay, and the purpose of the ship call. The current Danish Port Law doesn't mention information accessibility for crane booking, berth allocation and other services. This thesis recommends the Danish Ministry of Transport to consider the future digital role of the Danish port authorities. The Logistical process model (Figure 33) provides a clear illustration of the possible digital developments of the Danish Port Authorities.

RECOMMENDATION TWO: CONSIDERATION OF PORT COMMUNITY SYSTEM FOR DENMARK

To increase cooperation between other port actors, there should be two neutral, transparent, and trustful platforms under one port authority (e.g. recommended ship plan). The Port Community System (PCS) should be under a neutral party, and all port actors (including the port authority) should be able to share and receive information when allowed by the information owner. The following services can be offered in the port community system.

- *Port call optimisation:* The port call optimisation service will focus on the vessel arrival to the vessel until discharge. In addition, it also includes the invoicing procedure of the commodity dues and ship dues.
- *Cargo notification:* In the port community system, the cargo notification service will focus on the arrival of the vessel to the arrival of the cargo to the destination.
- *Terminal system connect to PCS:* The terminal system is an external system owned by the terminal which can be connected to the PCS.

- *Modalities notification:* The modalities notification service will focus on the inland transportation of the cargo. The modality notification tracks the truck or the rail transportation towards the port for loading the cargo and follows it to the final destination of the warehouse or consignee.
- *Port authority connected to Port community system*
- The port authority has the legal obligation to provide berths for the vessels. In this context the berth allocation and mobile crane allocation owned by the port authority can be connected to the PCS.
- *Nautical services*
- In the PCS, pilots and tugs can provide their booking services for the vessels. This can be included as a functionality of the port call optimisation service.
- *Port services*
- The port services of waste pick-up, request for water, and request for onshore electricity can also be provided in the PCS, either by having a port service booking system or by connecting to the port authorities' internal port service booking system.

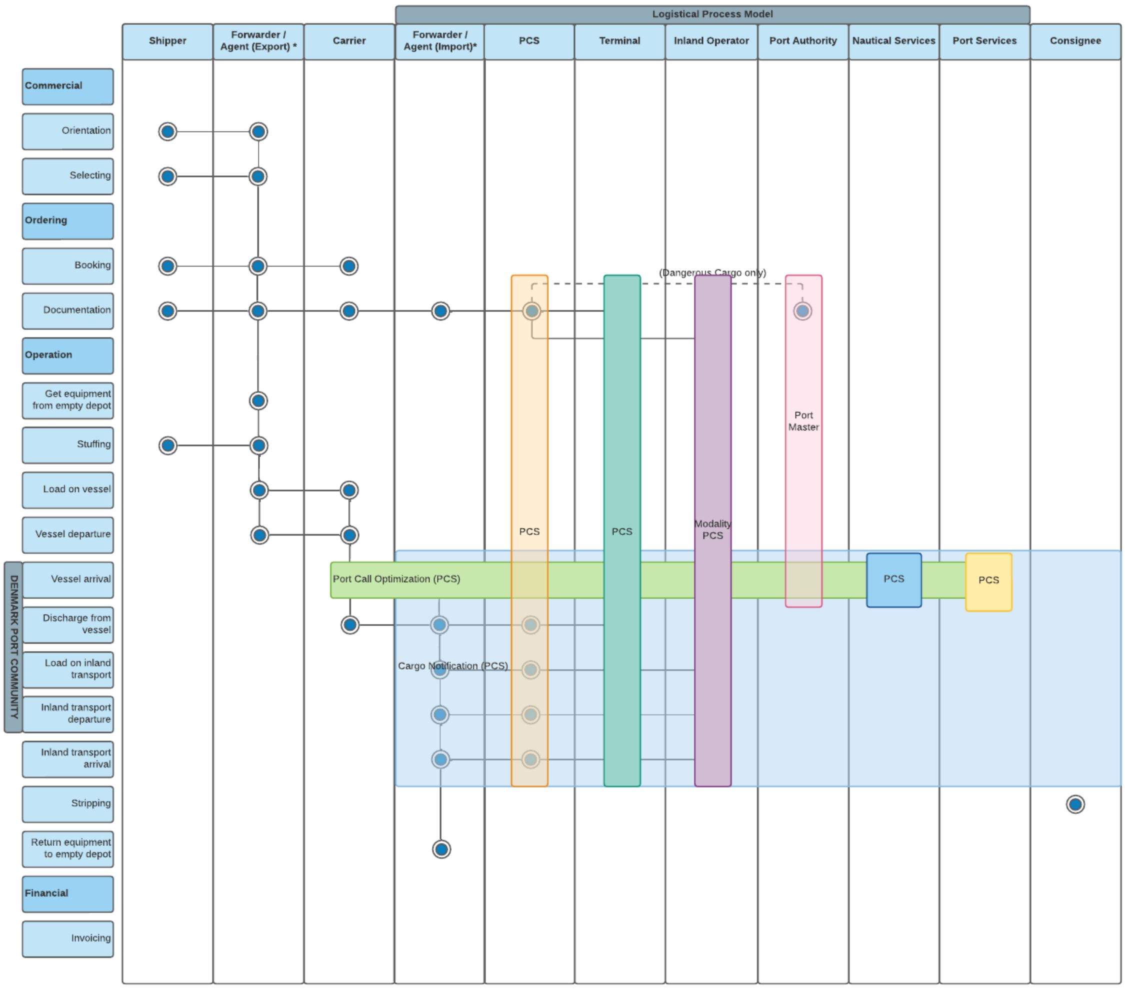


Table 17: Recommendation for Port community

In addition to the Danish Ministry of Transport, the Danish Shipbrokers Association, who represent shipbrokers, and the Danish Freight Forwarders Association, who represent freight forwarders should also be included in the development of the Port Community System. The role of the Port Community System should be clearly defined in the Statutory Order on Standard Regulations for the Observance of Good Order in Danish Commercial Ports under section 1(2) of Notification and section 3(3) of Berth. This will result in the Danish ports having the potential to become more competitive port in the Nordics.

In addition to these two recommendations, this thesis believes that all Danish ports should reorganise themselves as limited liability companies. The legislation should also set itself the target that the port sector should become a smart digital port sector. There should be clear rules of data governance (e.g., rules for data stewards to monitor data sharing, and rules for data owners to have control on their data) which should be explained and implemented by the Danish Ministry of Transport, Building and Housing.

6. MANAGERIAL CONTRIBUTION : DANISH HYBRID PORT AUTHORITIES AND PORT COMMUNITY SYSTEM

This thesis contributes two artifacts – the berth allocation and crane booking system – and a methodology for the Danish Port Authority to use in creating a digital port call optimisation platform. There are three areas in which port authorities under the ownership of limited liability companies can digitalise.

3.1 . PROCESS FOCUS (AUTOMATED INTELLIGENCE)

Process-focused digitalisation enables port authorities to optimise their manual business processes. This process-focused digitalisation provides services under pre-programmed rules for carrying out a repetitive but highly complex task. Danish port authorities can implement this development by inputting this information into their crane booking system for a vessel that has historically called frequently at the port. This would decrease the administrative burden for both stevedores and agents. The artifact[13] illustrated below provides the agents and stevedores with one location at which to control and monitor their booking processes, as well as to communicate bottlenecks early in the planning process. This thesis introduced two artifacts, (Figure (36) and Figure (37) , which can contribute to the attractiveness and port competitiveness of Danish port authorities. These two artifacts are recommended to the Port of Esbjerg, the Port of Aalborg, Port Koge, and ADP Port.

[13] A copy of the berth-booking and crane-booking system is included in the Appendix.

Decrease administration burden

The artifact is designed to decrease the administrative burden on agents, stevedores and the port authority. The artifact makes it possible to store historical data so that registry data, such as vessel characteristics, must only completed once in the system. Agents need not spend time sending emails with rectified information over and over again; rather, they can complete the information themselves in the artifact and control any changes needed. Similarly, the port harbour master need not check emails to match the berth request with the crane request, update the Estimated time of arrival rectify errors that contain easily accessible information.

Decrease change in location request

The artifact decreases the need for the crane to have a 'change of location' on the day of operation due to a low level of draught, which disrupts the planning of both the crane and berth allocation. This decreases the administrative burden of the customers and the port authority, providing additional time to focus on optimising customer service and being competitive in terms of providing services. In addition, the artifact decreases the invoicing procedure from 15 days to 24 hours by shifting from a physical collection and confirmation process to one that is digital and generates information from the artifact.

Digitalisation project collaboration

The artifact makes it possible for the port authority of Denmark to be involved with stevedores earlier in the planning process, not just on the day of execution. *Moreover, the artifact creates an environment in which shipbrokers and freight forwarders can share information with the port.* For instance, Artifact 2 (Figure 37) initiates the conversation regarding crane allocation priority and the mobile crane driver between different stevedores early in the process, with a contingency plan for vessel delays, rather than on the day the vessel is due to arrive. Similarly, Artifact 1 (Figure 36) makes it possible for agents to see the berth availability, as well as which berth may have been reserved by another agent, if the agents have allowed this information to be made public. If a desired berth is already reserved, an agent can collaborate with another agent at an early juncture in order to determine whether they can request the berth or coordinate with the other agent via port control to shift the vessel to another berth when they are idle.

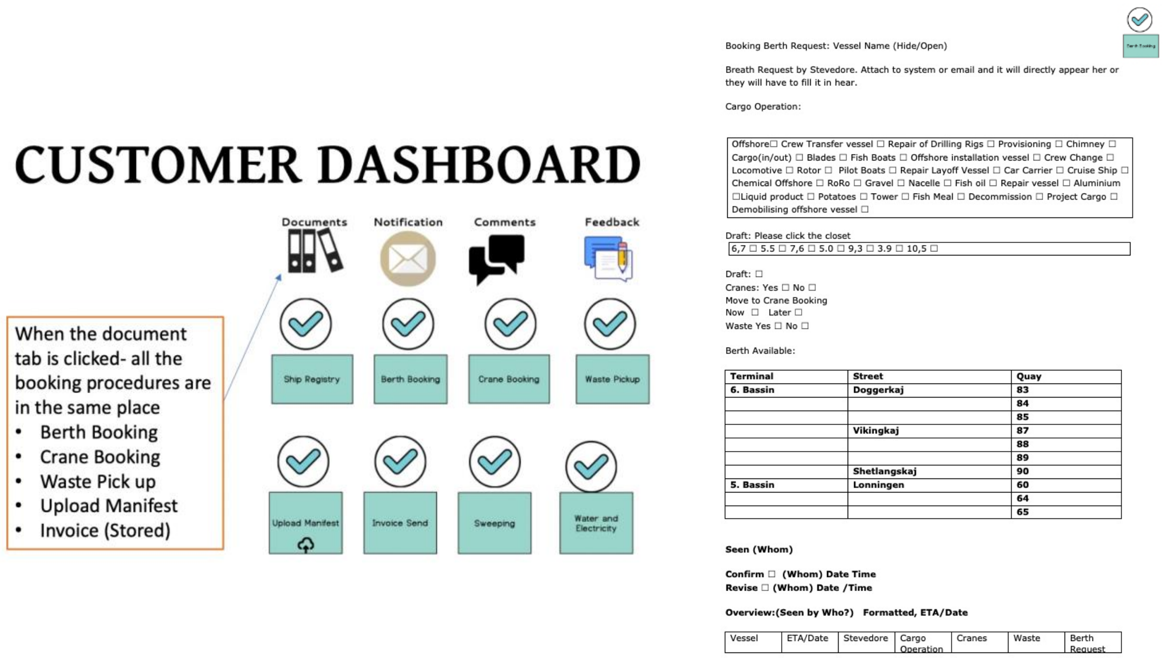


Figure 36: Process-focused Berth Allocation Artifact

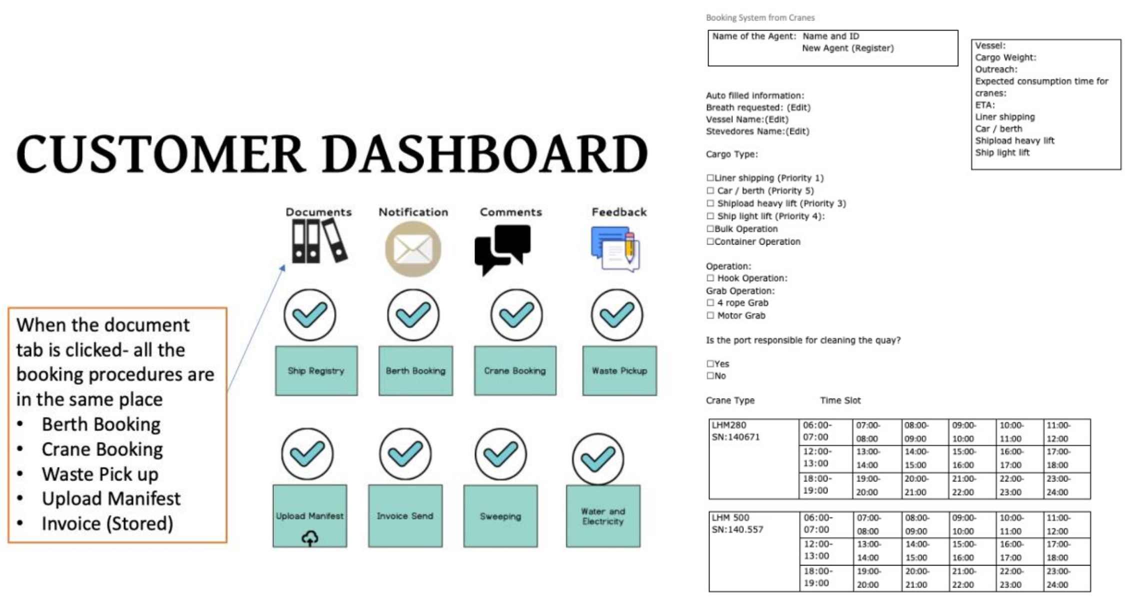


Figure 37:Crane Allocation Artifact

3.2. CUSTOMER FOCUS (ADAPTIVE INTELLIGENCE)

Customer-focused digitalisation enables the port authority to optimise its analytical AI layer so that machine learning can be used for self-learning and to adapt to changes. Port authorities can implement customer-focused digitalisation so that the autonomous invoicing of ship and commodity dues is generated. This digital platform would calculate all the services provided by the port authority to the agent, stevedore and vessel in one platform and send it to the customer for confirmation and payment. This thesis recommends this for their Danish Port Community system for the Danish Port Community. This PCS includes the artifact of the port call optimisation platform, which provides support from the Ordering step of to the Invoicing step of the logistical process model. This Danish Port Community system will be under the governance of a neutral party. For example, Figure (38), which represents the Danish PCS (Port Call Optimisation), shows that it will incorporate the following:

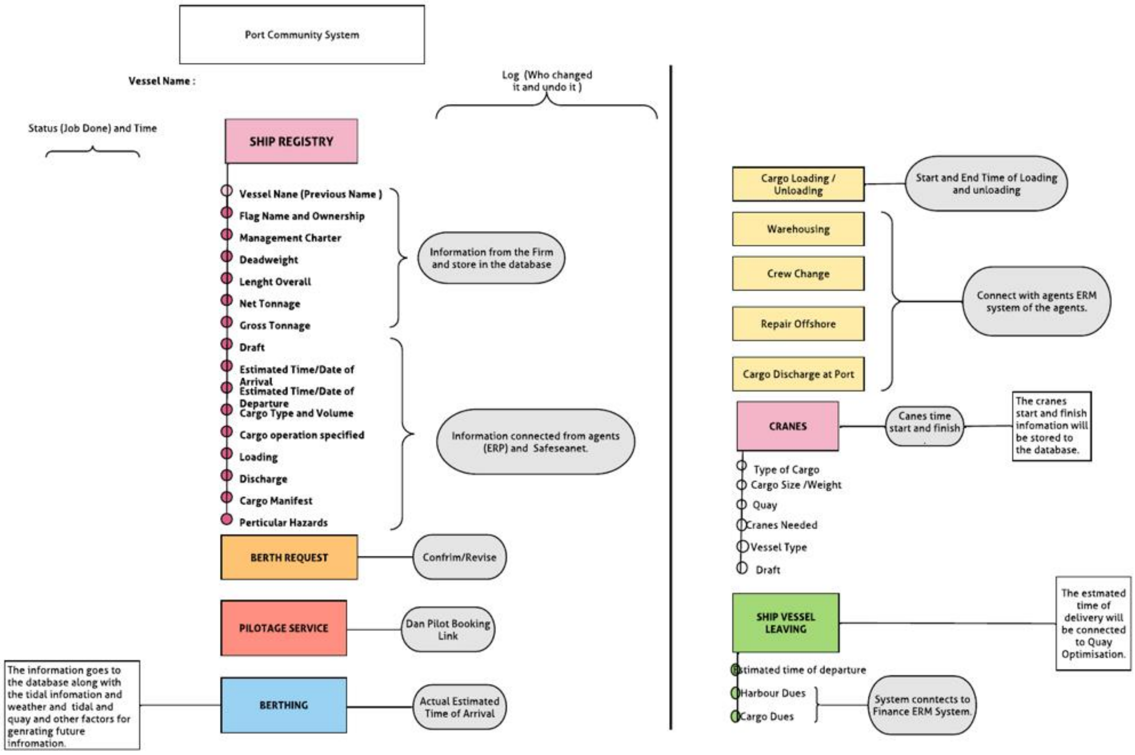


Figure 38:Port Call Optimisation

- *Ship Registry*

  The Ship Registry in the PCS will consist of the vessel name, flag name, deadweight draft needed, estimated time and date of arrival, estimated time and date of discharge, cargo type and volume, specified cargo operation, loading time and cargo discharge time, cargo manifest and dangerous cargo. The port community system will present the opportunity for agents and stevedores to control the traceability and transparency of their information.

- *Connection to Danish port authority (Berth request, crane request and ship discharge)*

  The Danish Port Community system will be connected to the systems of the Danish port authority. If the Danish port authority does not have a system but, instead, uses a manual process to planning berth or crane allocation (Excel or Navision), then the PCS can offer a berth-booking system for the Danish port authority in their own digital service portfolio.

- Connection to pilots
  The Danish Port Community system will connect to the pilot-booking system. This will provide the vessel or the agent the opportunity to book a pilot from the PCS. If the pilot company does not have an online system, then the PCS can offer this within their own digital service portfolio.

- Terminal notifications (cargo loading and unloading)
  In most of the Danish ports, terminal operation is performed by the stevedores. The PCS can help them plan and organise their loading and unloading operation. With the connectivity with port authorities, it can also be used to book mobile cranes from the PCS system.

- Crew change request
  The vessel can request and notify the port authority of crew change using the PCS.

- Repair request (offshore rigs)
  The vessel can also notify the port authority, agent and maintenance agency about upcoming repairs on the offshore rigs.

- Submitting vessel discharge
  The vessel or the agents can submit the final estimated time of departure within the PCS system. The ETD information can assist the port authority, agent and stevedore to begin the invoicing process.

7. CONCLUSION

Overall, in answering the question 'How can port authorities develop their business in the current port reform/governance landscape?', the conclusion of this thesis is that the three streams of research answer the question of 'how' by presenting the antecedents needed by the port authority to recognise opportunity, to understand the characteristics for implementation, to inspire customer collaboration, and to develop a methodology which can test the value of the entrepreneurial strategy. The other 'how' that this thesis contributes is the content of the digital information sharing strategy. This is a new form of business strategy that will bring more insights to port authorities about where to improve, what services to create, and how to stay competitive in the market.The conclusion of this thesis is that a port community system is the first step on Danish ports' journey toward digitalisation. The PCS provides a platform for all-inclusive services, i.e., port call optimisation, terminal operation, hinterland connectivity and invoicing. Due to Danish port legislation, Danish port authorities are limited in their digitalisation initiatives. Therefore, they also limited in terms of contributing to port competitiveness. To build an all-inclusive data-sharing platform, major changes must be made to the Danish Port Act. This thesis does not view that as an optimal solution and suggests the Danish Port Association, Danish Freight-Forwarding Association, Danish Ship Broker Association and Danish Shipping Association should collectively organise a PCS.

8. LIMITATIONS

With regard to the empirical contribution, this thesis is a longitudinal study, and the majority of the data collected are specifically related to Denmark and different port companies. This can be perceived as a limitation as some aspects of the research might be limited to Denmark due to its unique geographical location, culture and regulation, and therefore it may not be applicable or replicable in other diverse environments. In addition, the contribution of the Port Law Act is given based on the output presented by the Expert Committee in 2018, which is still in review and will probably not feature in the forthcoming legislative programme. Although this thesis can give recommendations on this issue, it should be borne in mind that the 2018 legislation may still not see completion. In addition, even with the compliance to the recommendation the Danish Port law has limitations, to future mature towards a Hybrid port governance these changes should also be corroborated with the Danish Competition Act; the piloting regulations; and infrastructure regulations for ports for ferry development.

BIBLIOGRAPHY

Kirzner, I. M. (1973). *Competition and Entrepreneurship*. https://doi.org/10.7208/chicago/9780226375489.001.0001

Korsgaard, S., Berglund, H., Thrane, C., & Blenker, P. (2016). A Tale of Two Kirzners: Time, Uncertainty, and the “Nature” of Opportunities. *Entrepreneurship Theory and Practice*, *40*(4), 867–889. https://doi.org/10.1111/etap.12151

Lugt, L. M. van der, Langen, P. W. de, & Hagdorn, L. (2017). Strategic beliefs of port authorities. *Transport Reviews*, *37*(4), 412–441. https://doi.org/10.1080/01441647.2016.1245685

Wang, P., & Mileski, J. (2018). Strategic maritime management as a new emerging field in maritime studies. *Maritime Business Review*, *3*(3), 290–313. https://doi.org/10.1108/mabr-06-2018-0019

Yang, H., Lin, Z. J., & Peng, M. W. (2011). *Behind acquisitions of alliance partners: exploratory learning and network embeddedness*. *54*(5), 1069–1080.

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