CHALMERS
UNIVERSITY OF TECHNOLOGY

Feasibility of Data Sharing Concepts in the Cruise Ship Industry

An Analysis of Cruise Ship Port Calls and Potential of Process Optimization

Master Thesis in the Master Program Maritime Management

ADRIAN BUMANN

ADAM PERSSON

MASTER'S THESIS E 2019:76

Department of Mechanics and Maritime Sciences
CHALMERS UNIVERSITY OF TECHNOLOGY
Gothenburg, Sweden 2019
Report No. E 2019:76

Feasibility of Data Sharing Concepts in the Cruise Ship Industry

An Analysis of Cruise Ship Port Calls and Potential of Process Optimization

ADRIAN BUMANN

ADAM PERSSON

Examiner: Dr. Monica Lundh

Supervisors: Professor Scott MacKinnon, Mr. Reto Weber and Dr. Mikael Lind

Department of Mechanics and Maritime Sciences

CHALMERS UNIVERSITY OF TECHNOLOGY

Gothenburg, Sweden 2019

Feasibility of Data Sharing Concepts in the Cruise Ship Industry

An Analysis of Cruise Ship Port Calls and Potential of Process Optimization

ADRIAN BUMANN

ADAM PERSSON

Master Thesis E 2019:76

Department of Mechanics and Maritime Sciences
CHALMERS UNIVERSITY OF TECHNOLOGY
SE-412 96 Gothenburg, Sweden
Telephone: + 46 (0)31-772 1000

Gothenburg, Sweden 2019

Cover: Author's Illustration

Abstract

In the wake of digital transformation, various projects in the maritime industry aim at improving efficiency and enhancing existing business models using digital solutions. The maritime industry is characterized by various competing agents interacting in a self-organizing ecosystem, leading to an overall lack of collaboration. Port Collaborative Decision Making (PortCDM) is a data sharing concept aimed at providing a basis for the collaboration between key actors within the port and towards its surrounding by enabling situational awareness. This shall be accomplished by introducing a standardized way of capturing and sharing time-related information from various sources. Previous research suggests operational inefficiencies in various shipping sectors which PortCDM aims to reduce by enabling Just-In-Time (JIT) operations. There is however little research on the operational efficiency of the cruise sector. As the cruise ship sector has grown continuously in the last three decades and operates with a very different business model than the cargo sector, it requires a dedicated approach.

This thesis aims to create an understanding of possible operational inefficiencies within the cruise sector and potential benefits of a data sharing concept. To achieve this, a literature review was performed to gather background information about the cruise sector, port infrastructure and digital innovation in the maritime sector. 11 semi-structured interviews with professionals and researchers in the maritime industry were conducted and analyzed. A quantitative data set showing schedule deviations of 38 ships over a time period of three years was analyzed. A discussion is presented that combines the findings of the literature review and quantitative and qualitative analysis to answer the two research questions. Finally, a conclusion summarizes key findings and gives indication for potential further research.

The results indicate that the cruise sector has a high operational efficiency compared to the cargo sector and thus would benefit less from JIT operations enabled through data sharing concepts. However, other benefits were identified. These include supporting agents and pursers in their operational capability, enabling improved connectivity for tourism-related service providers and facilitated coordination in case of complex schedule deviations including multiple actors and short time frames. On a larger scale, a widespread adoption of data sharing concepts may facilitate benchmarking capabilities, allow new business synergies and reduce organizational and regional heterogeneities. This will require sharing competences both within and between relevant organizations.

Keywords: Port Operations, Cruise Ship Industry, Operational Efficiency, Port Call Optimization, Data Sharing, Just-In-Time Operation, Sea Traffic Management, PortCDM, Maritime Informatics

Acknowledgments

Firstly, we would like to offer our sincerest of gratitude to the Göran Johansson Stiftelsen who supported this thesis. We would also like to acknowledge and thank our supervisors Scott MacKinnon and Reto Weber at the Chalmers University of Technology and Mikael Lind at the Research Institutes of Sweden (RISE). They guided us through the thesis with great commitment and provided us with valuable advice and feedback.

We would like to direct a special thank you to the cruise company employees who entrusted us with the data set and all the interview participants who shared their time and reflections with us. They provided the foundation for this thesis and allowed us to gain valuable insights in a highly interesting and relevant topic.

List of Abbreviations

ACDM	Airport Collaborative Decision Making
B2B	Business to Business transactions
B2C	Business to Customer transactions
B2G	Business to Government transactions
CDM	Collaborative Decision-Making
DSP	Data Sharing Potential
EDI	Electronic Data Interchange
ETA/ETA	Estimated Time of Arrival/Departure
EC	European Commission
EU	European Union
G2G	Inter-governmental transactions
G2C	Government to Customer transactions
GT	Gross Tonnage
HFO	Heavy Fuel Oil
HSE	Health, Safety, Environment
ICT	Information Communication Technology
IMO	International Maritime Organization
IPCSA	International Port Community System Association
IPCDMC	International PortCDM Council
JIT	Just-in-Time
LNG	Liquid Natural Gas
M2M	Machine to Machine
MSW	Maritime Single Window
NSW	National Single Window
PA1, PA2, …	Person interviewed for this thesis working in a shipping agency
PC1, PC2, ...	Person interviewed for this thesis working in a cruise ship company
PCMF	Port Call Message Format
PCS	Port Community System
PL/O	Port Logistics/ Operation
PMS	Port Management System
PR1, PR2, …	Person interviewed for this thesis involved in research in shipping
PO1, PO2, …	Person interviewed for this thesis working onboard a cruise ship
PP1, PP2, …	Person interviewed for this thesis working in a cruise port
PortCDM	Port Collaborative Decision Making
RISE	Research Institutes of Sweden
RP	Replacement Port
SAR	Search and Rescue
Shorex	Shore Excursion
STEAM	Sea Traffic Management in the Eastern Mediterranean
STM	Sea Traffic Management
SW	Single Window
UN	United Nations
UNCE	The United Nations Economic Commission for Europe
VTS	Vessel Traffic Service

Table of Contents

Table of Figures

1 Introduction

This section presents the background, aims and limitations for this thesis.

1.1 Background

The cruise ship industry has become an important market within both the shipping and the tourism sectors. Since the end of the 20th century, travelling by cruise ship has evolved from a luxurious and exclusive activity to a popular and affordable means of vacation. An entire industry has been created to cater to the needs of cruise ships and its passengers and the market has grown steadily in the last three decades (Dowling, 2006). In 2018, over 26 million passengers travelled by cruise ships, which is an increase of 270% over the last 15 years (Cruise Market Watch, 2018).

Digital transformation is an important process in the business world as it can potentially lead to increased efficiency and enhanced business models by creating new technological opportunities. As the maritime sector is a self-organizing ecosystem which includes a variety of actors, many digital improvement concepts focus on enabling enhanced connectivity between these actors. An example is Sea Traffic Management (STM) Validation Project, an EU-financed large-scale project which aims to increase efficiency by enabling the real-time exchange of data in the shipping sector. PortCDM (Port Collaborative Decision Making) is part of the STM project focusing on the optimization of port calls by enabling sharing of timestamps between all involved actors (Watson, Lind et al., 2017). This would provide both economic and environmental benefits as an improved capacity utilization would result in less time spent at sea and thus reduced fuel consumption (Bouman, Lindstad et al., 2017).

There are various studies analyzing operational port efficiency. The majority of these however focus on cargo shipping and little studies have been done on the cruise ship segment. Furthermore, it is difficult in finding a single definition for port efficiency, as different studies focus on different factors.

A number of studies suggest a link between port ownership and operational efficiency, with an optimal extent of privatization ranging between 67% and 100% (Blonigen & Wilson, 2006; Cullinane, Song et al., 2002; Tongzon & Heng, 2005). Additionally, quality of port infrastructure, size and implemented measures to reduce ship turnaround time were shown to be major influences on port efficiency (O. R. Kennedy, Lin et al., 2011).

The common business model used in cargo shipping relies on a ‘first come, first serve’ practice. Ships aim to arrive as early as possible to a port to fulfill their obligations towards the charterer. This led to a system of multiple independent actors which are competing against each other and are careful to share information. At the same time, it results in high fuel consumption due to high speed and waiting times at the anchorage (Lind, Haraldson, Karlsson, Watson et al., 2015). This mentality is also represented in commonly used charterparties (Eskelinen, 2018).

Johnson and Styhre (2015) found that in short sea bulk shipping ships spent half of their time in port, and of that time, 40% was used inefficiently. A main reason was ships arriving too early at the port before stevedores were ready. As optimizing the port operation would result in less time spent in port and thus lower average speeds at sea, the study estimates possible energy efficiency increases of 2 – 8% (Johnson & Styhre, 2015).

In an analysis of 55 "Tier 1&2" European ports, which were classified as handling at least one regular weekly call of a deep – sea container ship, 38425 container ships accumulated 71202 hours of waiting time before entering the port, or 1,85h in average per call. While the financial impact depends highly on the related operating cost, an estimation of this waiting time would be approx. EUR 100 million per year. The major causes for these waiting times are attributed to port and waterway congestion, weather related delays and terminal operating delays, including equipment malfunctions (Lind, Lane et al., 2018). As this does not take into account losses from smaller ports, ports outside of Europe or cargo operation taking longer than scheduled, the global losses would be higher.

Rygh (2018) analyzed in a master thesis port call operation in cargo shipping in Rogaland, Norway, using quality management methods "TQM" and "Lean". The thesis indicated that optimizing operational efficiency, i.e. avoiding late or early arrival of ships, services and goods, could lead to substantial savings. Applying those findings worldwide, potential savings would amount to at least 12 billion USD. To achieve such savings, it would be necessary to enable safe, sufficient and reliable information and to distribute it early enough. As for reasons causing deviations, weather was found to be one of the most common reasons. Even though that could not be avoided, it was found that there was high improvement potential on an organizational level to mitigate the impact. This would include measures such as better data sharing or rescheduling port calls (Rygh, 2018).

There is little research available regarding either the operational efficiency or the potential of a data sharing concept in the cruise ship sector. Due to the various differences in the business model, it is difficult to transfer findings about cargo ships towards cruise ships.

1.2 Aims of Thesis

The aim of this thesis is to:

1. analyze what factors lead to inefficiencies in port operation of cruise ships.
2. evaluate the potential a data sharing concept, such as PortCDM, can bring for port operation of cruise ships.

The goal is to expand the existing research on the environment and operational efficiency of the cruise ship sector and to identify possible improvement opportunities which would lead to environmental, economic or social benefits.

1.3 Scope and limitations

This study consists of a review of pertinent literature, an analysis of a data set of cruise ship schedule deviations and 11 interviews of professionals from the shipping sector.

Both the data set and the selection of interview participants had limited explanatory value regarding geographical differences. The data set did not include the original itineraries of the affected ships. This made it impossible to analyze operational efficiencies by geographical areas. The interview participants were largely based in North Europe. The data sets included in this analysis were for those that had scheduled deviations exceeding one hour.

There are other innovative projects in the maritime sector focusing on benefits through digital transformation besides PortCDM. PortCDM was chosen because of its large-scale approach which includes a variety

of European ports, shipping companies and research institutes. PortCDM is still in a validation phase as of time of writing and although the validation process has delivered some empirical results from experimental testbeds, there is little data on potential application specifically in the cruise ship sector.

2 Theoretical Framework

This chapter presents the theoretical framework and is divided into five subsections. First, value creation and digital innovation processes in shipping are defined to give an understanding how new concepts can add value. The business model and operational characteristics of the cruise shipping industry are described to give an overview of the industry. Ports are described and an overview of recent efforts towards digital standardization in port infrastructures is given. The PortCDM concept, its scope and findings from its validation project are introduced. Finally, a brief overview of research methods for quantitative and qualitative analysis is given.

2.1 Value Creation in Shipping

There are various frameworks for value creation. Porter (2004) defined a *value chain model* as "chained linkage of activities that exist in the physical world within traditional industries, particularly manufacturing". In the context of cruise shipping, every stage of a voyage can be seen as physical activity creating value, e.g. passenger satisfaction and financial revenue. Another approach is the *value network concept* which considers value creation as the result of interaction and combination of multiple players in a network rather than being the end result of a linear chain (Peppard & Rylander, 2006). This requires a holistic view of all involved actors and their interactions as this shifts the focus from a single company towards the entire value-creating system. While both approaches have their merits, Haraldson (2015) suggests integrating both approaches. This results in a multi-organizational perspective where value is created both in the actor relationships and the actions performed. The type of interactions depends on the context and can be described as episodic couplings for which the involved parties share information about their intention to coordinate to achieve a certain goal, like two actors agreeing a meeting at a certain time and place. Such episodic couplings are typical for inter-organizational systems (Watson, Howells et al., 2013).

This framework applies to the shipping sector, where multiple actors collaborate in episodic couplings to achieve a common goal (Haraldson, 2015). The main actor in this system is the carrier, i.e. the ship, which carries cargo or passengers, aided by a number of third-party service providers. According to Johansson, McHugh et al. (1993), third-party service providers can provide value in (1) improving the quality of service, (2) lowering cost or in (3) time reduction. To achieve this efficiently, the involved actors must coordinate and exchange their plans and expectations. In an ideal scenario, all actors would operate and communicate in an integrated and standardized system. However, most communication in this process is still done by means like phone or e-mail which have limited means of connectivity (Lind, Bergmann et al., 2018).

2.1.1 Digital innovation

Lambrou (2016) describes digital innovation in the shipping industry as:

> *"the transformation of shipping services, operations and processes ashore and onboard, and organizational methods that enable performance benefits for shipping companies, their customers and supply chain collaborators, as interrelated with changes in the shipping macro environment and enabled by maritime technology"*

As in other transport industries, digital innovation is an important factor in developing business models in shipping. In the last decade, this has manifested in organizations adopting new processes or adapting existing processes drawing on technical innovation. This includes operational processes, such as energy efficiency monitoring, voyage management systems or e-navigation, as well as financial management instruments, such as performance monitoring systems or portfolio management (Lambrou, 2016). There are many studies which analyze innovation management, i.e. how an organization can manage, implement and monitor the use of innovation (Afuah, 2003; Davim & Machado, 2015; Goffin & Mitchell, 2017). In a shipping context, important factors have been named as geography, size, organizational governance and particular shipping market characteristics (Lambrou, 2016).

This thesis however does not focus as much on individual organizations rather than on the cruise sector as a whole. In an analysis of digital innovation in the port sector, Carlan, Sys et al. (2017) found that supporting factors for innovation success were a combination of appropriate infrastructure, market demand, a promise of economic benefit as well as building or acquiring necessary capabilities. A major challenge was the inclusion of up- or downstream stakeholders, mostly due to differing economic and operational interests. Combining these interests in the form of co-innovation was named as the "most important challenge for the port industry in the decades ahead" (Carlan, Sys et al., 2017). Jenssen (2003) reached a similar conclusion after analyzing innovation strategies in the Norwegian maritime industry, stating that integrating competencies in and between organizations can lead to innovation and economically and environmentally sustainable competitive advantages. This includes especially horizontal and vertical cooperation with other organizations which can produce unique capabilities which are hard to reproduce.

Watson, Lind et al. (2017) compare physical and digital innovation in the shipping industry, naming containers and digital data streaming respectively as "seed ideas". These are innovations in themselves but are also necessary to enable an even bigger, globally spread system of innovation. For containerization, it was not only the original idea – transporting goods in standardized boxes – but also the surrounding system which enabled rapid and global distribution. This in return helped involved actors to develop supporting technologies like multi-modal transport solutions. Key factors in this process are governance and standardization as they minimize uncertainty. This allows third parties to plan accordingly and adapt their business model to offer suitable services. In containerization, the spread of the technology began to gain momentum mainly after being specified in an ISO standardization, leading to today's situation where transport costs have an almost negligible financial impact on a product. For companies, this results in the possibility to gain competitive advantages if they manage to adopt by implementing appropriate technical, financial and organizational solutions to new innovations.

In digital innovation, digital data streams are named as requirements for enabling more advanced digital solutions. One area where this has happened already is the Automatic Identification System (AIS) technology which automatically transmits information about a ship's status to receivers in the area. This in turn has enabled various third-party services which aim at increasing efficiency by using AIS data, such as green routing, green steaming (Watson, Lind et al., 2017), SAR and safety appliances (Jotron, 2019), shoreside monitoring or accident investigation (Harati Mokhtari, Wall et al., 2008). Digital data streams are named as a possible key for developing other message formats to enable a holistic connected environment, leading ultimately to innovations such as autonomous shipping and sustainable multi-modal transportation. Figure 1 below illustrates for an overview of seed innovation emerging from digital data streaming, and the standardization thereof (Watson, Lind et al., 2017).

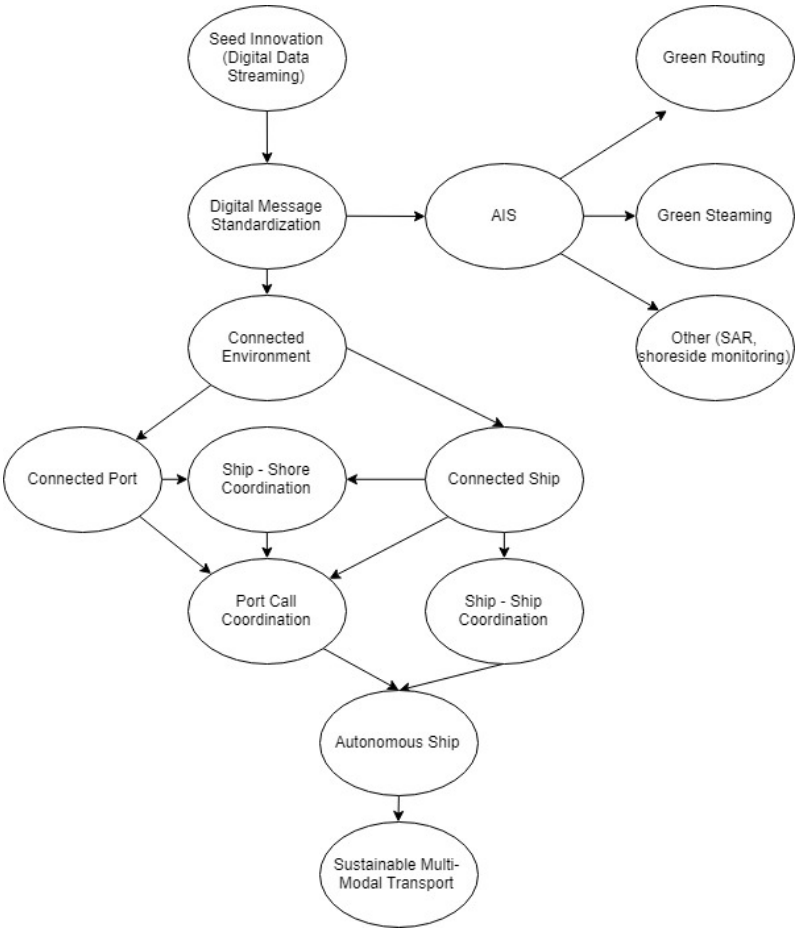


Figure 1 – Innovation in Shipping, branching out from a Seed Innovation (adapted from (Watson, Lind et al., 2017)

2.2 Cruise Shipping

2.2.1 Cruise Ship Market

The cruise ship industry is small in comparison to the cargo shipping sector, with 314 ocean-going ships in 2018 (Cruise Market Watch, 2018) making only approximately 0.6% of the world merchant fleet (UNCTAD, 2018). The cruise ship market is an oligopolistic industry and largely owned by four corporations with various sub brands. The market has grown constantly in the last decades, with an annual passenger growth rate of 6.6%, and is expected to continue growing (Figure 2 & Figure 3). This trend shows in the shipyard order books, with 37 new ship builds scheduled in the next 2 years and a trend towards larger size and capacity (Cruise Market Watch, 2018).

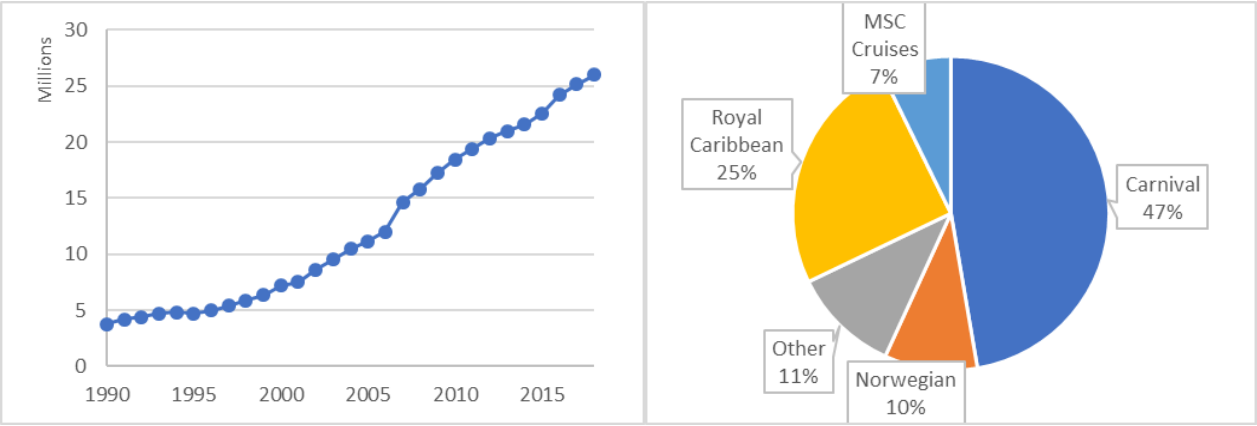


Figure 2 & Figure 3 – No of Cruise Ship Passengers 1990- 2018 & Distribution of Passengers 2018 (data from (Cruise Market Watch, 2018))

With the growing market, popular cruise ship ports are expected to receive more demand for access. Most cruise voyages are located in North America, the Caribbean, Northern Europe and the Mediterranean (CLIA, 2018). A common business model for a cruise ship is to stay in a certain geographical region for several months and transfer to a different region when the season changes. The Mediterranean, Northern Europe or Alaska are most popular in summer, while destinations in the Caribbean peak during winter months (Rodrigue & Notteboom, 2013). Plans to expand the Chinese market in recent years failed due to high political and logistical issues (Micallef, 2018).

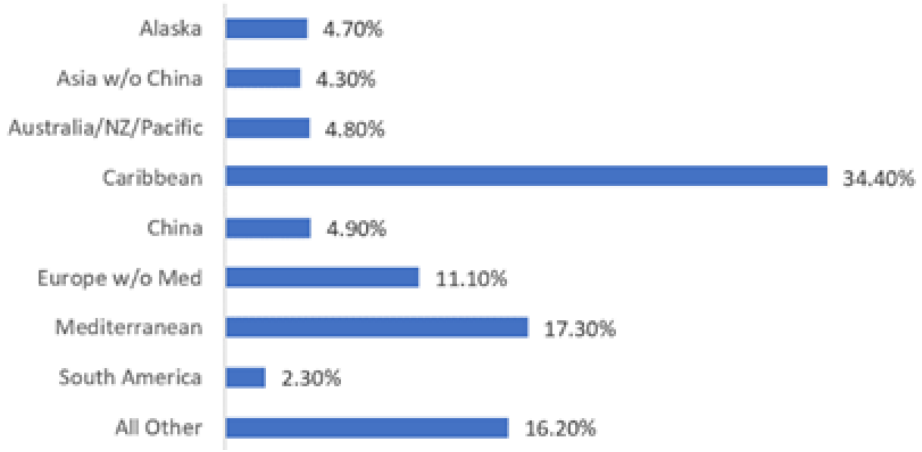


Figure 4 – Cruise Ship Deployment by Region 2018 (data from (CLIA, 2018)

2.2.2 Business Model

The general business model differs from the cargo industry. Usually, the ship owner acts as ship operator, removing charterparties and Notices of Readiness (NOR) from the process (Dowling, 2006). Port schedules are usually prepared up to 2 years in advance. This enables the company to plan other activities related to the customers' experience, such as bookable shore excursions in the respective port. While this long-term planning and predictability approach is similar to the container liner shipping industry, the latter is usually designed for repetitive weekly schedules all year, while cruise itineraries fluctuate geographically by season, and even then execute different cruises to offer variety to passengers (Wang, Wang et al., 2017).

The three major companies aim to differentiate their sub brands from another by building recognizable and specific products to cater to different customer groups. This includes luxury, family or themed cruises. Within a cruise company, the service planning is usually done individually by ship and not for the entire fleet (Rodrigue & Notteboom, 2013). This results in a scenario where two cruise ships with the same capacity and same route can have vastly different service requirements (Wang, Wang et al., 2017).

A cruise ship's itinerary normally includes one home port and several transit ports. The home port usually has good transport connections and is used to exchange the majority of passengers and is considered as a logistics hub. The transit ports are excursion destinations for the passengers (Wang, Wang et al., 2017). There are various factors a cruise company must consider in their scheduling process – seasonal weather conditions, duration of the overall cruise, balance between time in port and at sea, popular tourist attractions in transit ports and overall customer satisfaction. Additional technical aspects include nautical accessibility of ports, i.e. draft restrictions or size of turning basins, availability of berths and availability of third-party services. Further considerations include the existing supply and demand. The supply side includes vessel deployment and product offerings of competitors and existing market structure, i.e. which competitors exist and what cruise configurations they offer. The demand side includes definitions of targeted customer groups, their preferences and potential revenue sources (Rodrigue & Notteboom, 2013). The popularity of cruise ports has been shown to be an important factor for customers in their selection process (Boonzaier, 2017). This can lead to cruise companies competing against each other in the port scheduling process (Penco & Di Vaio, 2014).

Once these factors have been analyzed, companies will decide on specifics of the cruise. Most cruises have a duration of three to ten days. Longer cruises exist but are less common and less attractive in revenue while seven – days cruises are the most common product, making 47% of all offerings in 2011 (Rodrigue & Notteboom, 2013). Draft restrictions in ports generally tend to be a smaller issue than for cargo ships as cruise ships have a comparably low draft. Additionally, cruise ships are able to anchor in smaller ports and deploy own or chartered tender boats which transport passengers ashore (Rodrigue & Notteboom, 2013). A popular example is the island Santorini (Greece, see Figure 5) where up to six cruise ships per day are staying in the bay off the tender port (Santorini Port, 2018).

In contrast, the availability of berths is a much more restrictive factor for cruise ships than for cargo ships. Most popular cruise ports have only a limited number of berths which offer the appropriate infrastructure and proximity to attractions (Wang, Wang et al., 2017). Gothenburg (Sweden), as an example, offers two cruise berths, Amerikaskjulet and Arendal. The smaller one, Amerikasjkulet, is both restricted by air draft (45m), draft (7.5m) and pier length (220m) and therefore only used by comparably smaller ships , while Arendal is usable for larger ships with a length up to 300m. Newer ships are often larger than that and have to berth at the container terminal Skandiahamnen which neither is as attractive as the centrally located Amerikasjkulet nor has the facilities of Arendal (Port of Gothenburg, 2018a).

Figure 5 – Cruise Ships and Tender Boats in the Port of Santorini (Bumann, 2015).

Environmental concerns have become a growing issue in the recent years and cruise ships have repeatedly been criticized for their high air emissions in port (R. D. Kennedy, 2019). Cruise ships have a significantly different and higher energy consumption than cargo ships of a comparable size due to the various consumers in the hotel operations (Brynolf, Baldi et al., 2016). Ports and shipping companies have made efforts in

the past to tackle that issue, including offering reduced port fees for ships with a specific performance in environmental indices (Port of Gothenburg, 2018b) or building new ships with hybrid or fully LNG powered engines (Jordan, 2017). Initiatives to provide cold ironing, i.e. on-shore power capacity, to remove the need for onboard generators, have been considered in various major ports like Hamburg, Venice and Barcelona. However, high costs of implementation and retro-fitting ships, the lack of technical and legal standardization and the high energy consumption still pose major challenges for these technologies (Rodrigue & Notteboom, 2013).

A finalized itinerary is characterized by few main variables – number and order of home and transit port, distances and required speed. If delays happen in that itinerary, it is common practice to sail with an increased speed to avoid future deviations from the schedule resulting in higher fuel consumption. Rodrigue and Notteboom (2013) categorize cruise itineraries into three types. *Perennial itineraries* cover a geographical region all year. A good example would be the Caribbean or the Mediterranean which have stable temperatures and cruise traffic all year round, even if the amount of traffic is lower in summer/winter respectively. *Seasonal itineraries* are serviced exclusively in a certain season, again mostly due to weather. Examples include the Baltic Sea or the Persian Gulf, where cruise traffic ceases in winter/summer due to inhospitable temperatures or ice conditions restricting navigation. When transitioning from one seasonal itinerary to another, cruise companies offer *repositioning itineraries*, which have different departure and arrival home ports. Examples include transatlantic cruises or cruises from Europe to the Persian Gulf. When stationed within one region, it is common for companies to offer differing routes. The level of such variation depends on various factors, such as vessel size, customer group, operational cost, branding and cruise offer. Common to all types of itineraries is that they are tightly scheduled and leave little room for unintended schedule deviations (Rodrigue & Notteboom, 2013).

2.2.3 The Port Call Process

A port call of a cruise ship is a highly complex process involving multiple actors and is characterized by a high need for schedule accuracy. While there is no research paper available to the knowledge of the authors describing the actors and their interactions in a cruise ship port call, there are multiple papers which focus on different aspects of such a port call. Gui and Russo (2011) look at the cruise port as nexus between the global value chain of cruise lines and the regional land-based services. London and Lohmann (2014) analyze the power relationships between key stakeholders involved in development and operation of cruise infrastructure, with a focus on cruise lines, ports and local communities. In another paper, London (2013) presents economic risks during different phases of the product life-cycle in the cruise sector and possible impacts on involved actors. Vaggelas and Pallis (2010) identify and categorize available services in 20 major European passenger ports, including both ferry and cruise ports, and analyze the benefits on the public and private sector. Véronneau, Roy et al. (2015) identify various service suppliers for cruise ships and analyze the supplier relationships in the service supply chain of cruise suppliers and the environment in which they operate. Lind, Andersen, Bergmann et al. (2018a) divide the port call in different chronological stages and identify multiple actors and events which require collaboration (see Figure 6).

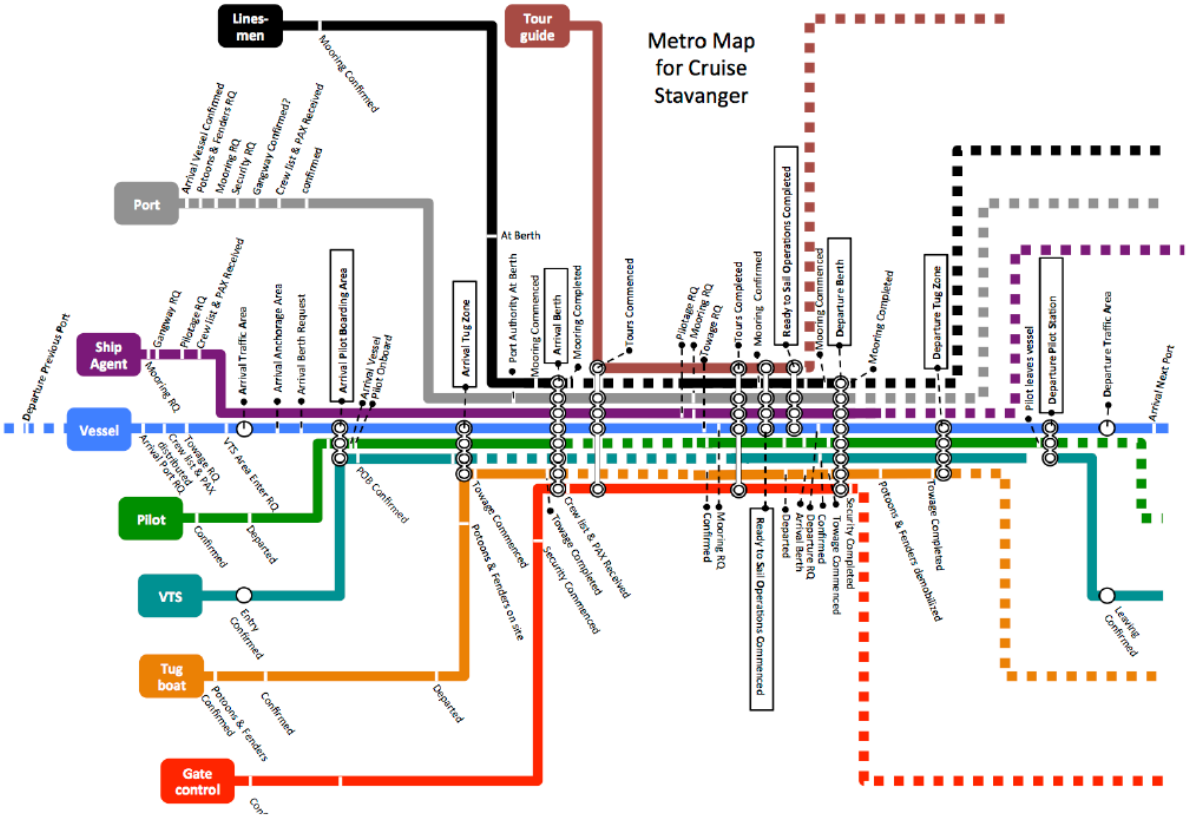


Figure 6 - Actors and Events associated with Cruise Line Calls (Lind, Andersen, Bergmann et al., 2018b)

Figure 7 displays the actors and their relationships described in these papers. It is based on the "inseparable trinity in sea transport" by Lind, Haraldson, Karlsson, and Watson (2015) which describe shipping company, port operators and cargo owner as the main actors in the cargo shipping value chain.

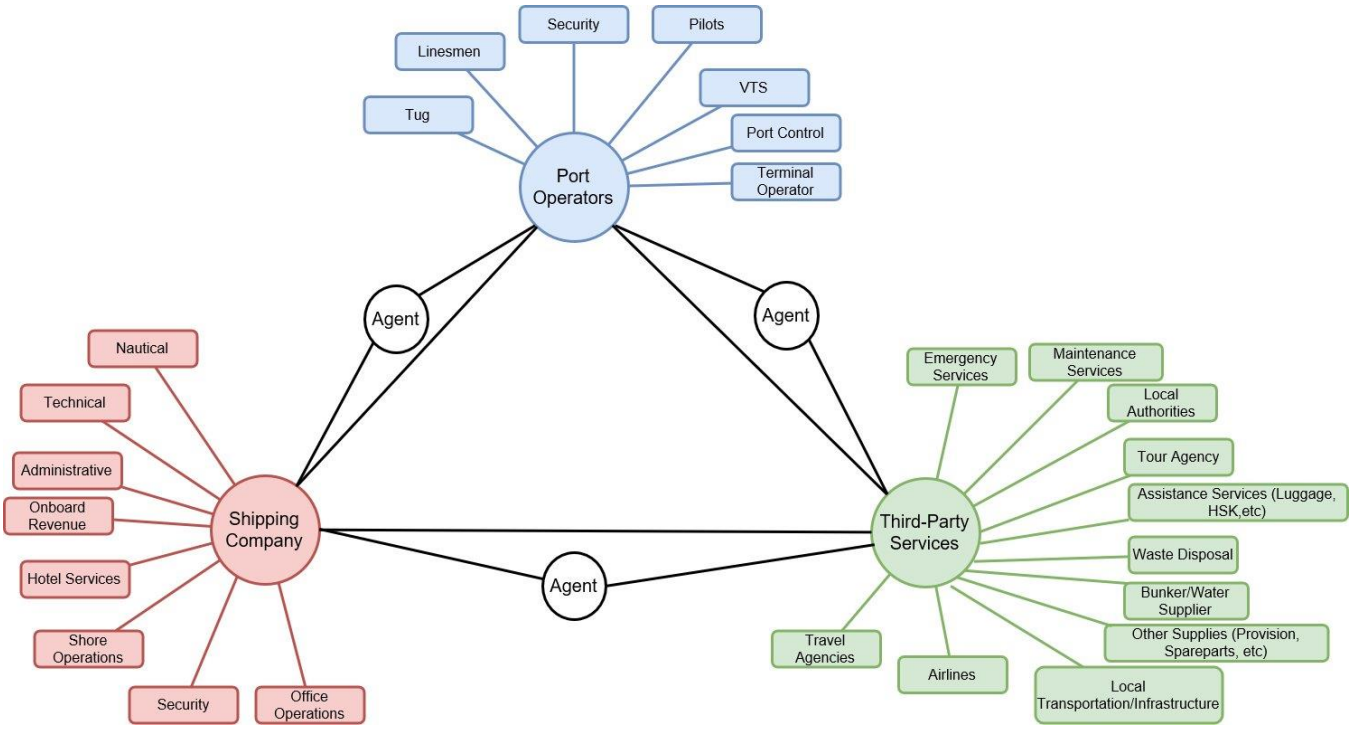


Figure 7 – Trinity in the Cruise Value Chain (data adapted from (Gui & Russo, 2011; Lind, Andersen, Bergmann et al., 2018a; Vaggelas & Pallis, 2010), model based on (Lind, Haraldson, Karlsson, & Watson, 2015))

Actors within the port provide services to facilitate arrival/departure and usage of the port's infrastructure. This includes pilots, linesmen, port control and tugs (Gui & Russo, 2011). These services are the same provided for cargo ships, although cruise ships may use them to a different extent. As an example, large cargo ships often use tugs for berthing, while cruise ships usually have better maneuvering capabilities but would require tugs in case of strong winds due to their large windage. Other examples would be increased efforts in security measures or cruise ships requiring more experienced pilots (Vidmar & Perkovič, 2015).

Third-party organizations provide services related to the ship's operation and passengers. This includes delivery of supplies and bunker, local tour agencies for shore excursions or airlines. Again, some of these services are the same as for cargo ships but may be used to a larger extent, such as waste disposal. In case of emergencies, local emergency services like firefighters or ambulances could be required (Gui & Russo, 2011).

Onboard of the cruise ship, there are multiple departments usually separated into Nautical, Technical and Hotel with various sub departments. Therefore, different persons are responsible for handling the port and third-party operations, e.g. the bridge personnel interacting with port control or the Shore Operations Manager with local tour agencies (Dowling, 2006). A local shipping agent is usually employed by the cruise line to aid in organizing these processes and communicate with local parties. However, he/she acts as a communicator and has little control over the respective operation. The number of involved actors and operations make a cruise ship port call a highly complex process involving a high degree of communication, coordination and collaboration (Gui & Russo, 2011).

During the port call, there are two especially time-sensitive operations. Firstly, shore excursions in transit ports are an important factor in most cruise business models to enable a positive customer experience and thus revenue. These are usually organized by local agencies and sold by the cruise company in advance or onboard to the passengers. These excursions are often tightly scheduled within the laytime to use the time most efficiently. The organization of these excursions can also differ from port to port, depending on customers' preferences, local infrastructure and destinations (Rodrigue & Notteboom, 2013). Gui and Russo (2011) classified cruise ports depending on the tourism flows which shows that the infrastructural requirements for ports can be highly different. In that example, shore excursions in a "Black hole" port may suffer from inner-city congestion, while excursions in a "gateway" port have long distances to cover from port to destination (see Figure 8). Furthermore, Gui and Russo (2011) describe a trend of both cruise lines and global shoreside tourism operators pushing towards a more vertical integration in the cruise value chain. This leads to those two players offering services which are otherwise offered by local actors. Examples are cruise lines operating own terminals and tourism agencies managing hotels, shipping agencies or tour agencies in different ports. In the case of globally operating tourism agencies, this enables cruise lines in having a single contact for multiple destinations, facilitating the planning and communication process and reducing costs (Gui & Russo, 2011).

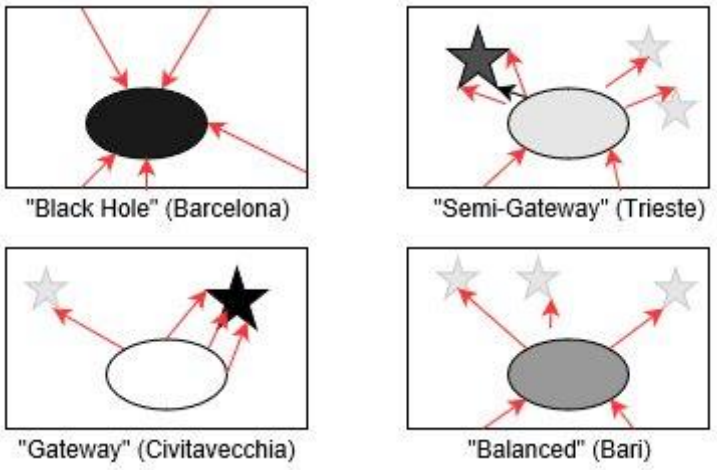


Figure 8 – Typologies of Cruise Ship Ports with arrows indicating Tourism Flows to Port or External Destinations (adapted from (Gui & Russo, 2011))

Secondly, flights related to passenger exchange in home ports are necessary to allow passengers to embark the ship outside of the passengers' geographical home region and are often sold by the cruise company in combination with the cruise itself. Both flights and shore excursions are influenced by various factors outside of control of the cruise company, such as third parties and the local infrastructure. In case of unexpected schedule delays, the company must decide whether to delay their stay in port and thus sail with higher speed and fuel consumption to the next port, or to cut the excursion short or let the passengers embark in a different port respectively, potentially resulting in decreased customer satisfaction and reimbursement claims (Gui & Russo, 2011).

2.3 Ports

2.3.1 Port Governance

Ports around the world differ greatly in size, properties, ownership and governance. Therefore, it is not possible to formulate a standardized blueprint for port structure and operation. Depending on the ownership structures of a specific port, the organizational structure and operational management differ greatly. Traditionally, ports have been under state-ownership, controlled and operated either by the state or a designated local public municipality port authority (Bichou, 2009). However, in the last two decades the operational frameworks, structures and strategies of cruise ports have changed in several respects. A wave of reforms has accompanied the infrastructure renewals and considerable cruise port investments around the globe to accommodate the increasing fleet of cruise tonnage, both in sheer physical size and in number of ships in service (Pallis, Arapi et al., 2019). The traditional ownership structure of cruise ports being solely owned and operated by the state has been replaced in many geographical regions by a variety of ownership models. This often goes along with a power shift from port authorities to private cruise terminal owners. These terminal owners often are horizontally integrated entities with cruise terminal ownership and operation in various geographical locations and has become a viable business model. Vertically integrated business models are becoming more common in the value chain of major cruise corporations, owning not only ships but also terminals, service providers and real estate in the surrounding port area. The latter has become a challenge for local municipalities in enabling suitable supply chains and to receive their share in the value chain (Pallis, Arapi et al., 2019).

2.3.1.1 Different Roles of Public and Private Actors in Port Management

Rodrigue (2017) distinguishes five main models of port governance and administration based on the responsibilities of the public and private actors. These five models differ in terms of port management and role distribution between the actors, ranging from wholly owned, control and operated public ports to its private counterpart. A common port structure is the landlord port, balancing the interests of both government and corporate actors, placing itself in the middle of the spectra, as shown in Table 1.

Table 1 - Public and private roles in Port Management (adapted from (World Bank, 2007)

	Ownership	Port admin.	Nautical mgmt.	Port Infra.	Superstructure	Cargo handling	Pilotage	Towage	Mooring services	Dredging
Public Service Port										
Tool Port										
Landlord Port										
Corporatized Port										
Private Service Port										

■ Public Responsibility ■ Private Responsibility

Clarification of the various management roles as depicted in the above figure (Rodrigue, Slack et al., 2006b):

- **Public service port:** A wholly public owned and controlled port structure, where the port authority performs the whole range of services.
- **Tool ports:** Similar to a public service port in every aspect except the outsourcing of terminal operations to private actors. Equipment such as pipelines and cranes for cargo operations or facilities

for passenger movements are owned by the port authority. A natural transition from inefficient public service ports by utilization of specialized service operators.

- **Landlord ports:** A common mode of ownership balancing public and private interests. Ownership of major infrastructure such as terminals are mostly owned by the port authority and subsequently leased to private operators through concession agreements. A lease is paid to the port authority with business models varying depending on port particulars. Responsibility of ensuring regulatory compliance and minimum standards relating to terminal operating equipment is also transferred to the private terminal operators, thus hedging risk for port authorities.
- **Corporatized ports:** In a corporatized port management structure the public is still the major shareholder, but with the port authority in almost all aspects mirroring a private enterprise, thus separating ownership and governance. The port authority is operating the port is faced with the same pressures of delivering financial yields and producing positive shareholder value as any private entity would be.
- **Private service ports:** A completely privatized port structure, where ownership and control are retained by private stakeholders. All administrative port functions are performed by the private owner and operator, with a limited governance from national maritime- and other regulatory bodies to ensure compliance with regulations.

2.3.1.2 Role of the Public Port Authority

An important central player in the port network of actors is the public port authority. It is a function present in most port ownership and management models, albeit with varying executive power depending on the ownership and operational parameters within certain ports. A port authority is the entity of state or municipality that owns, operates or provides terminal facilities, quays or other marine service at ports. The very first port authority was set up in London already in 1908 by consolidating all existing facilities, and structurally became a standard to be adopted by other ports. The reasoning behind the consolidation of harbors under a unified public umbrella was to ensure efficient operations and mitigating risk exposures of investing in small isolated terminals (Rodrigue, Slack et al., 2006a).

As mentioned in Section 2.3.1.1, the role of port authorities has changed on a global scale. Starting with the emergence of capital demanding specialized container terminals acting as gateways and critical links in the global multimodal logistics networks, public authorities have gradually stepped aside to make room for horizontally integrated terminal companies, operating large networks of terminals across the globe (Pallis, Arapi et al., 2019).

In many of today's major hubs, the port authorities have shifted into roles of landlords, governing terms and policies through concessional agreements that stipulate leases and payment structures. Port authorities also carry the responsibility to globally market their geographic location to attract new customers, and act as a driver for port infrastructure development. While the drive towards changes in ownership structures can be attributed mainly to the above logistic evolutions, the cruise industry has capitalized on similar concessional agreements to operate networks of designated cruise terminals (Rodrigue, Slack et al., 2006b).

2.3.2 Port Community Systems

A Port Community System (PCS) is defined as an electronic platform or information hub interconnecting the multiple systems used by various actors within a geographically bound port community, for example an air- or seaport. Usage of the system is set up and organized to cater to the common needs of the various organizations operating in the port community. This means that the services included in a certain PCS, and the maturity level of Electronic Data Interchange (EDI) varies greatly between different Port Community Systems depending on several factors unique to every port (IPCSA, 2014).

The concept of inclusive Port Community Systems in the maritime industry is not new. Seaports were already starting to develop holistic systems for the heterogeneous collectives of port-related companies back

in the late 70s and 80s to meet the increasing needs for punctuality and reliability (IPCSA 2014). Lessons learned from early adopters were that standardized platforms to communicate between actors did not only increase efficiency, but also reduced costs and increased the competitive position of the ports. Data that had previously travelled with the ships, e.g. bills of lading, could, to a larger degree, travel ahead of the seaborne voyage by digital means, thus introducing increased flexibility to cargo operations. Further operational improvements of goods flow were achieved by the introduction and usage of digital transactional recordkeeping, made possible through the development of interconnected information hubs (Srour, van Oosterhout et al., 2008 Zuidwijk).

While a port is geographically bound to a certain location, a PCS does not necessarily need to be. It can pass information within supply chains, in between ports and various actors with shared interests. Automating and integrating information flows is the main focus in the development of port community systems, thus increasing the operational efficiency of existing processes and enables long-term discoveries of new operation techniques and synergies between connected actors. In the design of such functional system architectures, the role of standardization is vital in order to ensure that digital information can flow seamlessly. A common digital language and message exchange protocol is needed for supply chains to be truly interconnected (Srour, van Oosterhout et al., 2008 Zuidwijk).

The International Port Community Systems Association (IPCSA) is an organization set up to promote and lobby e-logistics solutions to public maritime/logistics policy makers. The association is governed by an executive committee consisting of the 6 founding membership organizations (PCSs). They are:

- **SOGET** (Le Havre, France)
- **dbh** (Bremen, Germany)
- **DAKOSY** (Hamburg, Germany)
- **Portic** (Barcelona, Spain)
- **Portbase** (Rotterdam, Netherlands)
- **MCP** (Felixstove, UK)

The IPCSA and its sub committees work to streamline efforts relating to PCS development. This includes issues and opportunities in the realms of standardization and new technologies, customs and government interfaces and new business applications. The official definition of a Port Community System as issued and worded by the IPCSA (2014) is a system that;

- *is a neutral and open electronic platform enabling intelligent and secure exchange of information between public and private stakeholders in order to improve the competitive position of the sea and aviation ports' communities;*
- *optimizes, manages and automates port and logistics processes through a single submission of data and connecting transport and logistics chains. (IPCSA, 2014)*

2.3.2.1 Port Information System Architectures

The focal point of most Port Community Systems is to automate and integrate information flows from different parties to ensure a smoother flow of physical cargo. There are several architectural types of Port Community Systems with varied backbones of transactional information flow. Traditionally, four main architectures have been predominant for EDI exchanges (see appendix 7.1 for more in-depth information and illustrations).

Srour et al. (2008) argue that the most efficient structure for service management applications is a N2M (Machine to Machine, with "N" referring to the number of connections) architecture with temporary instead of permanent linkages for information exchange. For this type of architecture, standardization is

critical to allow connectivity. It can utilize data storage clouds but is not necessarily forced to. Figure 9 provides a graphical illustration of such an information system architecture. PortCDM is based on M2M EDI.

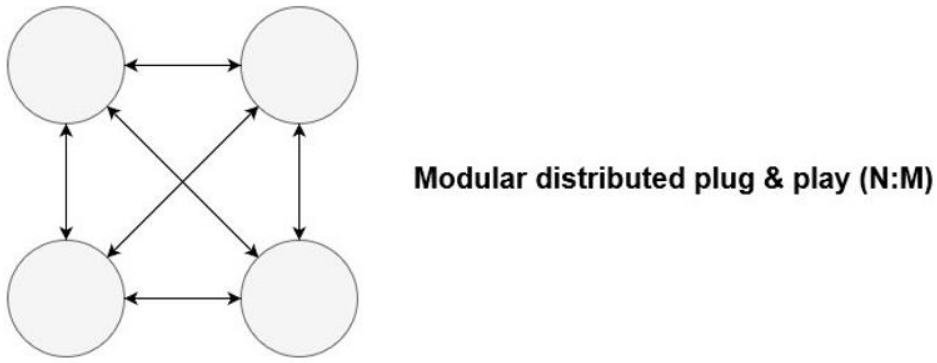


Figure 9 - Inter-organizational N:M architecture (Srour et al. 2008)

2.3.3 e-Maritime Initiative

The e-Maritime concept is an EU initiative to promote the use of advanced information communication technologies (ICT) for conducting business in the maritime transport sector. It specifically focuses on driving developments of integration and interoperability of IT systems between within-port and port-port. Many major European hubs of cargo and passenger traffic have advanced internal information system infrastructures, enhancing operational efficiency and producing considerable quality gains. However, the connectivity and interoperability between the different PCS, e.g. between Port A and Port B, remains largely non-existent or very limited. This lack of connectivity is thought to a substantial hindrance to the development of new services on a broader spectrum and limits potential benefits of economy of scale concepts (MED-PCS, 2013).

Prior to launching the e-Maritime initiative in 2010, the European Commission of mobility and transports analyzed the expectations and needs of the stakeholders through a survey. Amongst the 102 respondents were members of most branches of the maritime industry, ranging from port authorities, terminal operators and research institutes to ship's crew and IT companies. Identified key points were the clear absence of standardized reporting templates, data structures, and established procedures for reporting of information. Duplication of reports to various receivers were a clear source of annoyance for actors stating that they both wasted resources and increased the probability of errors in the reports due to the lack of interoperability between systems, within ports and port-port. The general consensus was that the initiative was duly worthwhile and important, and highlighted a mutual agreement that maritime reporting data should be submitted digitally only once and to one designated receiver only. Therefore, the technical standardization process, development and implementation of national single windows was to receive the highest priority in the EU e-Maritime initiative (European Commission, 2011).

2.3.4 Reporting Formalities Directive

In October 2010 the Reporting Formalities Directive (RFD) was adopted as an EU directive by the European parliament to harmonize submissions of reporting information in all EU ports of call. It set an obligation for member states to develop a national single window for reporting formalities to be in place and operational starting June 1, 2015. In order to assist member states in the adoption of the directive, the commission established the "eMS Group" to help guide the process of harmonization. Its compilation featured IT professionals from national maritime administrations, specialized in simplification of electronic information services. Other notable industry representatives were invited to participate in meetings as observers (European Commission, 2019). Figure 10 illustrates the vision and objectives of the directive.

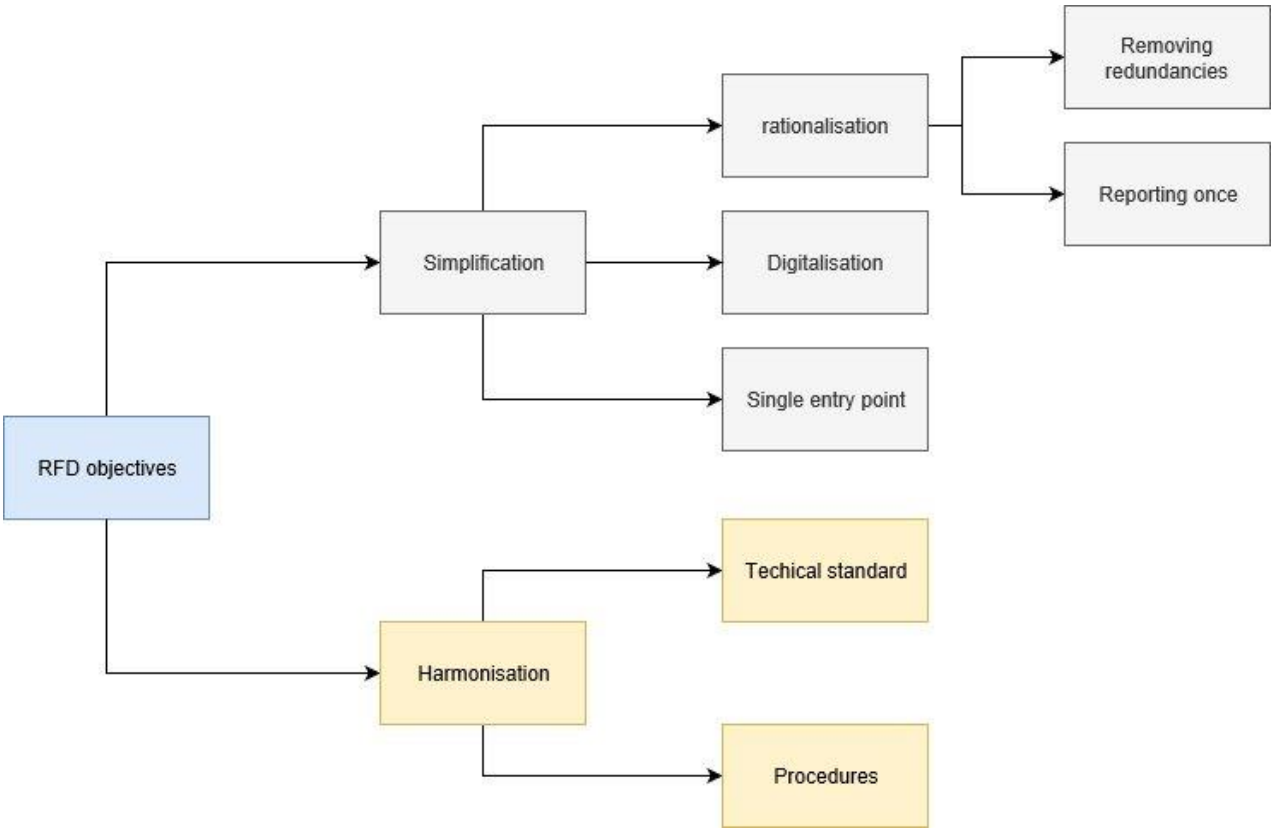


Figure 10 - Graphical illustration of the RFD objectives set forth in 2010 (European Commission, 2011).

The core concept of a single window is to provide a facility that allows actors engaged in trade and transportation to submit standardized information and documentation electronically only once, and to a single point of reception to fulfill all relevant regulatory B2G (Business to Government) compliances. These reporting compliances are relating to import, export and transit-related reporting regulations (UNCEFACT, 2012).

In the UNECE guide for trade facilitation and implementation key features of a single window are highlighted. It should be able to:

- expedite and simplify information exchanges between trade and governmental bodies;
- allow the lodging of information in a standardized format;
- provide a single-entry point of admission for all international trade transactions;
- allow submission to be limited to one entry, through non-redundant data fields;
- facilitate trade and economic development, thus bringing gains for all involved actors. (UNCEFACT, 2012).

2.3.4.1 Current European Maritime Single Window Environment

In 2016, the European Commission launched its first evaluation study of the RFD implementation resulting in disappointing findings. Paper reporting was still commonplace in 50% of the member state ports, often as a duplicate to electronic reporting. Furthermore, the reporting procedures were only fully digital in few selected countries. True single window submission and harmonization had been achieved in even fewer and the reporting information was seldom re-used between EU ports (European Commission, 2019).

The conclusions drawn from the study were that far too few processes had been harmonized on an EU level, with all implemented national single windows being fundamentally different. Thus, the European Commission evaluated that the positive impacts realized from the RFD directive were small, and in some situations even negative for the shipping industry.

In 2017, the transport ministers of EU countries signed the "Valetta Declaration", urging the commission to act to improve the shortcomings of the RFD directive. Suggestions to evaluate a genuinely harmonized European maritime single window were made and subsequently endorsed by the Commission. The limitations of the RFD and national single windows were to be solved by the implementation of a fully harmonized European single window environment. All interfaces available for ship operators are to be fully harmonized across Europe, with the same formatting and ICT. Furthermore, standardization of a maximum data set required for ports and terminal management needs to be established to ensure that data truly only needs to be submitted once. All relevant data already provided and available in the databases of authorities should be readily available, thus not requiring resubmission (European Commission, 2019).

2.3.5 Integration Between PCS and National Single Windows

There is considerable interconnectivity between PCSs and the single window concept. A PCS has the ability to act as a national single window or integrate into an NSW. Efficient interconnection is a key point to reduce duplication of data inputs. Integrated structures can be achieved in different levels. Figure 11 and Figure 12 below depict generalized illustrations of complementary and full integration.

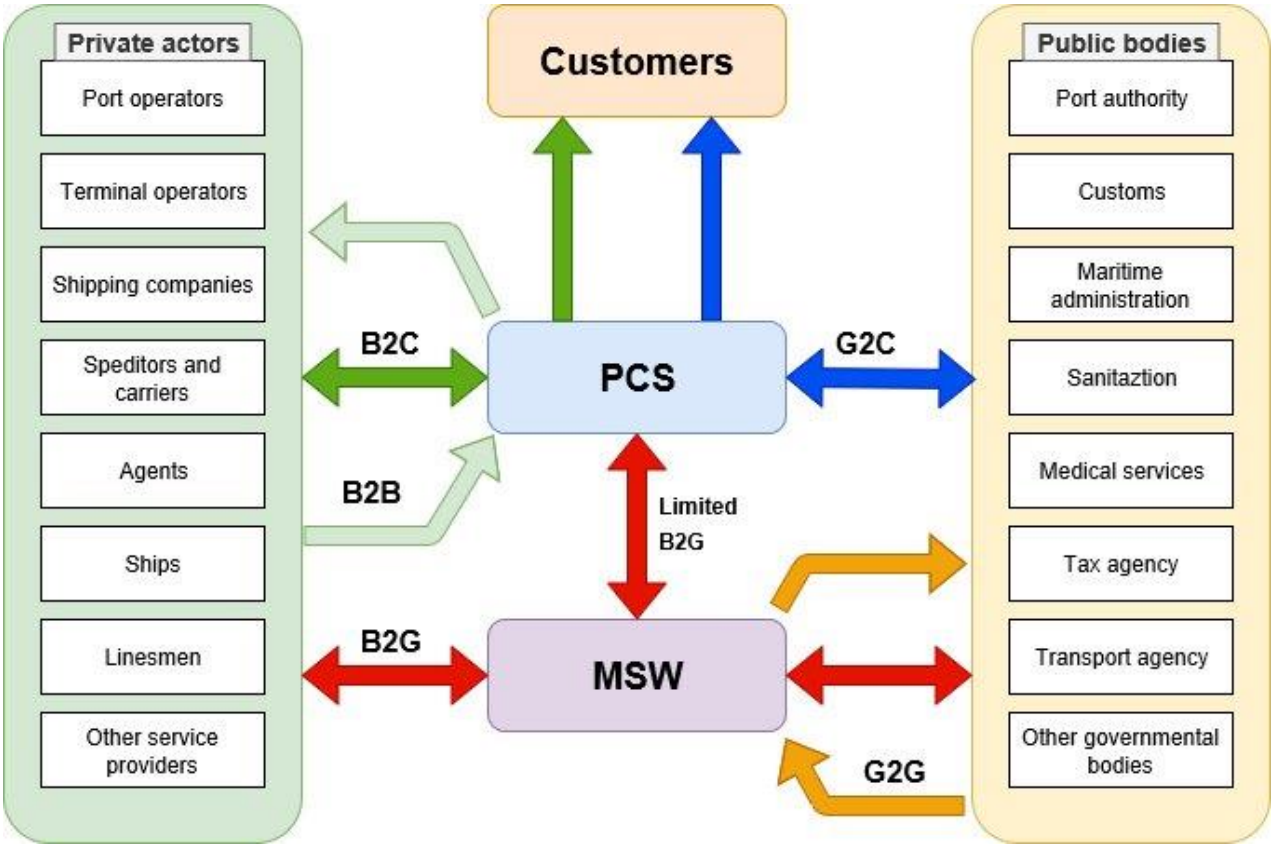


Figure 11 - Illustration of a PCS and SW as complementary systems. (adapted from MED-PCS, 2013)

In case of a complimentary but separate integration of a maritime single window into the port environment, the SW is mainly devoted to government to government (G2G) and business to government (B2G) information flows, while the PCS is the platform functions primarily for business to business (B2B) and business to customer (B2C) transactions.

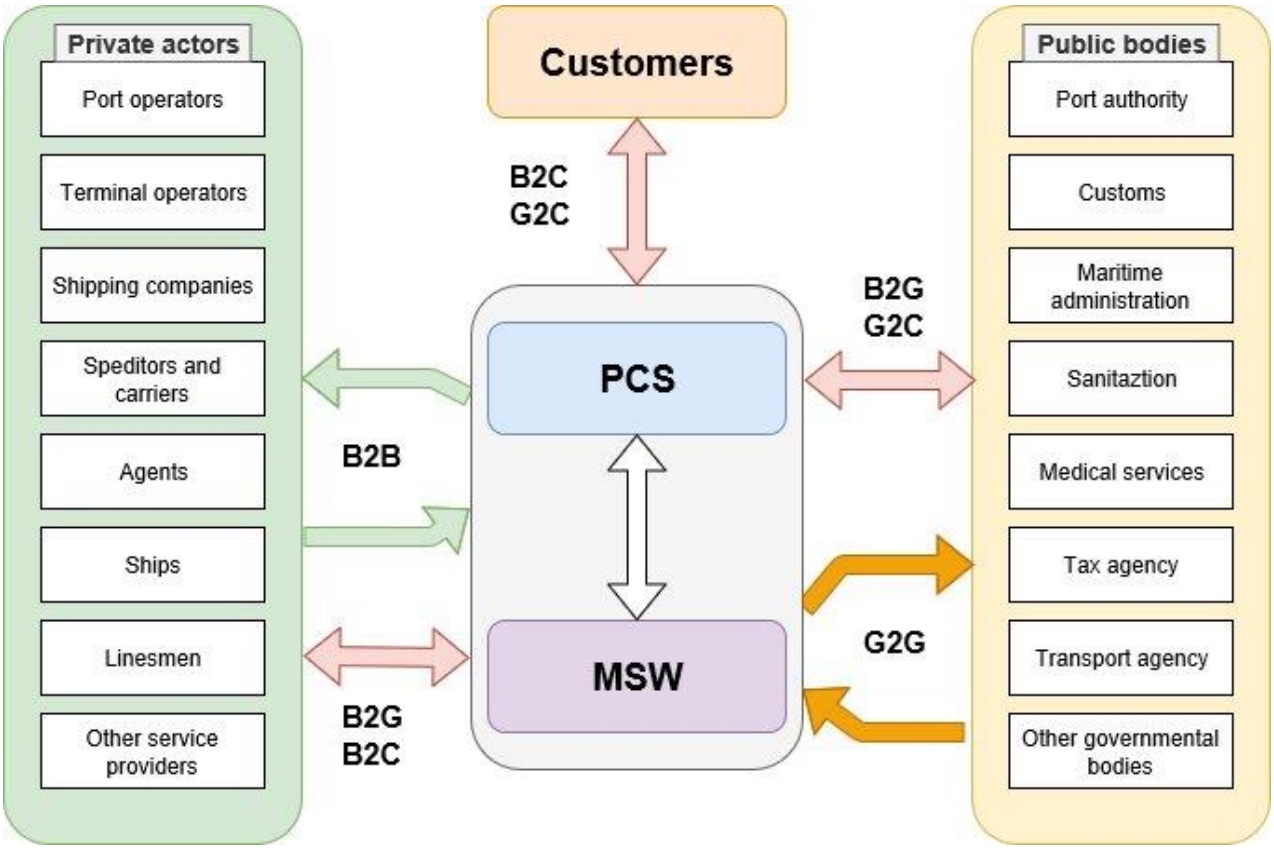


Figure 12 - Illustration of a PCS and SW fully integrated. (adapted from MED-PCS, 2013)

A full integration of the SW and the PCS allows for many operational efficiencies to be realized as true overall integration of all e-maritime principles vastly reduces potential needs for duplication of information to be submitted (MED-PCS, 2013).

2.3.6 Digital Transformation in Ports

The digital information transformation of ports can be categorized in three generations. A generation of reducing paper dependent procedures, to a generation starting with the introduction of the standardized container in 1956 to the beginning of the 1990s, where the next generational change in digital procedures emerged - focusing on automating procedures. Currently the industry is amid the third generation of digitalization of ports, starting after the global financial crisis 2008. Ports are gradually adopting digital strategies, often out of financial pressure to optimize their processes (Heilig, Schwarze et al., 2017).

Increased utilization of scalable cloud-based storage environments allows relevant information to flow freely between parties. Integration of within-port, actor-specific and external systems are seen as a major source of improvements in operational efficiency. Cloud-based solutions allow for adaptable scaling to meet dynamic and changing needs of the port community. In addition, connectivity of ICT systems between ports to form strategic partnerships are included within the scope of strategies. Further strategies also include development of tools and methods for analyzing big data amassed through various systems, and pinpoint areas of potential improvement for new strategic, tactical and operational decision making. Since data collection capabilities have vastly improved in both speed of information flow and amount of information exchanged, decision making needs to be sped up accordingly. Tools and processes for data analytics need to be designed with user functionality in mind to avoid information overload, to function as intended, to facilitate faster decision making. Availability, accuracy and transparency of shared contextual data allow for improved situational awareness of deficiencies. This facilitates for better coordination between involved parties and timely corrective actions (Heilig, Schwarze et al., 2017).

2.3.7 Barriers to Successful Implementations

At a collective level, the successful implementation of community information systems varies greatly on the long-term commitment of key actors. Common design elements, technologies, procedures and standards need to be agreed between the actors, with cost barriers of implementation carefully considered. Plug-ins to cheaper web-based exchange systems can allow smaller port-related actors to connect to the community information system, thus greatly increasing the diversity of actors (Srour, van Oosterhout et al., 2008 Zuidwijk).

Port information systems require both significant investments in time and money to implement. In every community system environment, there are actors who benefit less from participating in heterogeneous information systems, potentially hesitant to allocate resources to ensure system connectivity. Benefits of connectivity can be abstract and hard to grasp, with most potential operational benefits only being realized over a long period of time. Hence the adoption process can differ greatly between the different actors in a port. In cases of reluctant parties, it may be crucial for sponsors and a change agent to be present, promoting the involvement of all actors by demonstrating the clear benefits and in certain cases offer sponsorship. Such sponsorships may be financial aid and IT expertise, most commonly offered by dominant key parties and orchestrators of port community systems, such as the local port authority. Government sponsorship have been the foundation of many successful large-scale implementation, Port Infolink in the port of Rotterdam being a good example, where the port authority bore the investment costs in order to preserve and promote the competitive position of the port by investing in digital information maturity (Srour, van Oosterhout et al., 2008).

Srour et al. (2008) argue that a significant barrier to successful implementations is improper deployments of system modules, resulting in poor adaptation and system use, or ultimately causing actors to reject the system before proper cost-benefit estimations of usage can be made. Withdrawal of certain actors can affect the rest in the port cluster, so ensuring a smooth implementation can be crucial for the long-term success. This can be achieved by modular implementation strategy, starting small and adding on as development and functional accuracy is properly assessed. For every module implemented, the objectives and tangible benefits of its content should be carefully communicated to all actors, thus ensuring less reluctance to adapt their business practices and applications to interface with the port community system module. Safeguarding the continued interest and support of the heterogeneous port environment is therefore a main concern in the implementation process. Systems that try to accomplish too much upon initial implementation risks overwhelming the users, and if found to be lacking in quality, also face potential rejection. Deployment is not a one-time endeavor, but a continual process. Ensuring that a port community system or information platform can grow and evolve to adapt to new business opportunities is of utmost importance. It must be agile and flexible in order to remain relevant and beneficial for the business climate within the port, evolving as the needs of its stakeholders do to meet new challenges (Srour, van Oosterhout et al., 2008).

Another barrier to successful implementations of port community systems is the issue of sensitive information relating to data transmissions and shared databases. Information safety is a major concern for both private and public bodies, and an adequate level needs to be maintained to limit risks of intrusions (MED-PCS, 2013)

2.4 STM & PortCDM

2.4.1 PortCDM Conceptual Origins

The origins of PortCDM lie in the aviation sector. A concept called A-CDM (Airport Collaborative Decision Making) was developed and implemented, with the aim of improving operational efficiency, enabling easier coordination and synchronization of all involved actors and improving predictability (Eurocontrol, 2017). However, the number and organization of involved actors in aviation differ considerably from the marine industry. An airport has a more hierarchical structure within an airport authority, the Air Traffic Control having both authority and oversight over all involved actors. A marine port is more segregated and involves numerous independent actors, such as the port, cargo owners, shipping companies and various service providers. Therefore, this high degree of independence makes it difficult to directly apply aviation solutions toward the marine industry (Lind, Haraldson, Karlsson, & Watson, 2015). Due to these differences, the PortCDM concept has been adapted to suit the needs of the actors in maritime cluster.

2.4.2 STM & PortCDM Purpose & Concept

Port Collaborative Decision Making (PortCDM) is a part of Sea Traffic Management (STM, www.stmvalidation.eu), a concept being developed for the shipping industry, financed by the European Union. STM aims to increase safety and efficiency among involved actors in shipping by enabling and enhancing collaborations between actors. This shall be achieved by digital, real-time information exchange and shall result in improved economic, environmental and safety performance. STM includes four areas of application:

- *Strategic Voyage Management* (SVM) focuses on strategic decisions regarding voyage planning, e.g. which ports to sail to in which order
- *Dynamic Voyage Management* (DVM) aims to provide support for an optimized execution of the planned route
- *Flow Management* (FM) aims to improve coordination of multiple vessels in congested waters
- *PortCDM* focuses on the interaction between ship, port and hinterland operators (Lind, Haraldson, Karlsson, Watson et al., 2015)

To improve port operations, the PortCDM concept aims to promote:

- Extending the planning horizon via collaboration of actors within ports, between ports, between ships and ports, and between ports and hinterland operators
- Sharing time information of future events in the port call to improve coordination
- Combining data from various sources to enable enhanced analysis and reduce uncertainties
- Mutual situational awareness through data sharing among internal and external actors

This shall be achieved by:

- Enabling real-time information sharing among all actors, allowing easier synchronization and a holistic view of all processes, thus improving decision-making with all involved actors' interests in mind
- Enabling Just-in-Time (JIT) operation in the transport chain by coordinating ship's arrivals/departures and operations during the port call and reducing waiting times, both before and inside the port
- Coordinating cargo and passengers more efficiently, allowing for smooth operation in port and in the hinterland (Lind, Haraldson et al., 2019)

Collaborative decision making is enabled if all partners shares reliable, accurate and timely information, facilitated by standardized procedures, mechanisms and tools (Lind, Haraldson, Karlsson, & Watson, 2015). To enable an effective and widespread use, the developers of PortCDM aimed for a high level of standardization in three areas. On a technical level, PortCDM uses the digital data exchange standard S-211, based

on the S-100 standard endorsed by the IMO for e-navigation to enable integration with other systems. On an administrational level, an international PortCDM council (IPCDMC) aims to provide governance for the implementation. Finally, a framework for PortCDM maturity levels aims to aid in measuring success and impact of the use of PortCDM (Lind, 2018).

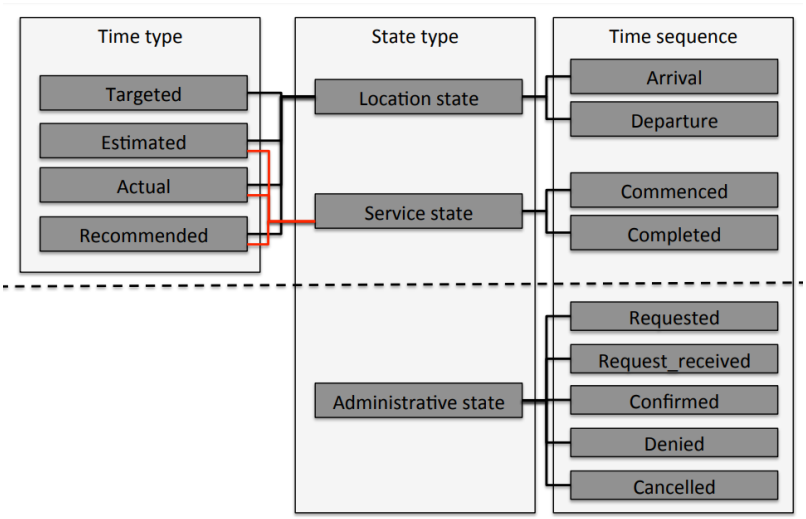


Figure 13 – Composition of Timestamp used in the Port Call Message Format (PCMF) (Lind, Bergmann et al., 2018)

The technical standard S-211 includes what type of data is exchanged with PortCDM. This is done in a format called Port Call Message Format (PCMF) which contains time-related information about a certain event and its involved parties' estimate when it is about to happen. This information is timestamped and is composed of three parts (see Figure 13):

- Time type – e.g. estimated, actual, etc.
- State Type
- Time Sequence

This enables various combinations – the ETA at a berth, confirmation that a ship has reached the pilot station or the completion of a specific service like loading of cargo. Furthermore, service states can be specified with status categories, like *requested, confirmed,* etc. Times and status can be updated during the port call process (Lind, Bergmann et al., 2018). Besides optimizing the actual port call operation, this does offer additional possibilities. Using such unified communication with timestamps would enable involved actors to collect data and develop benchmark tools or systems of record to improve future operation. Furthermore, the PortCDM concept foresees both back-end integration and front-end services (Lind, Andersen, Bergmann, Watson, Haraldson, Karlsson et al., 2018).

The PortCDM maturity framework has been developed to allow different organizations to implement PortCDM to an extent which matches their requirements. These requirements can change depending on various factors, such as different models of port governance, size and involved actors. The framework defines seven stages which describe the extent and technical and operational capability the port uses PortCDM.

Stage 1: Port is capable of sending and receiving S-211 PCMF timestamps
Stage 2: Port has established a data sharing platform; port actors use it voluntary
Stage 3: Internal "Core Port Call Actors", such as pilots, linesmen, share PCMF timestamps
Stage 4: All internal port call actors, incl. service providers like waste disposal, share PCMF timestamps
Stage 5: PCMF timestamps are used for communication with external actors like ports and ships
Stage 6: Holistic planning and coordination using PortCDM involving all actors
Stage 7: Development of KPIs using PortCDM to further improve port operation

Using this standardized framework, all actors involved in the port call could identify the organization's capabilities and know what to expect. It also enables a flexible implementation, depending on the existing capability and system in use (Lind, Andersen, Bergmann, Watson, Haraldson, Karlsson et al., 2018).

2.4.3 PortCDM Validation Project

The PortCDM concept has been tested and validated in nine port clusters, divided into two separate testbeds, the Nordic and the Mediterranean. During the validation process, port actors interacted continuously by sharing and evaluating PCMF timestamps. Meetings were also conducted in living lab workshops, which are user-centric research settings designed to foster co-creation and innovation. Throughout the process, nearly 1.7 million timestamps were successfully exchanged in 43976 port calls in demonstrator software for data-sharing, developed to reflect the principles of the PortCDM concept (Lind, Haraldson et al., 2019). An overview of the analyzed port calls is in Appendix 7.2.

The successfulness of the validation project was evaluated quantitatively by analyses of the accumulated data sets, and qualitatively by interviews, questionnaires and collaborative reflections within the port environments. Additional availability of reliable data, and an enhanced situational awareness facilitated by implementing PortCDM were evaluated to add positive value to port call operations. The key qualitative findings of the validation reports based on the responses of participants were that PortCDM facilitates (Lind, Haraldson et al., 2019):

- Improvements in estimation accuracy of ETAs and ETDs (100% of respondents agreed "to some extent" or "more")
- Improvements in work procedures (>50% of respondents agreed "to some extent" or "more")
- Reduction of time required to gather information (>80% of respondents agreed "to some extent" or "more")
- Reduction of administrative burdens (>805 of respondents agreed "to some extent" or "more")

The report also identifies various benefits for different stakeholders. Ships could adjust their speed in accordance to berth availability and thus reduce fuel costs and optimize their fleet usage. Terminal Operators and internal port actors would have an optimized usage of their resources/infrastructure and would benefit from an enhanced basis for planning. Hinterland operators (e.g. truck operators and warehousing facilities) would have reduced waiting times and could easily be integrated in port processes (Lind, Haraldson et al., 2019). The interaction between ports could be especially useful in short-sea shipping, where there are short intervals between scheduled ports (Lind, 2018). A decreased turnaround time in port can also enable ships to reduce speed between ports which directly lowers fuel consumption and emission, thus saving money and lessen the environmental impact (Eide, Longva et al., 2011; Faber, Nelissen et al., 2012). While there are various possibilities to reduce CO_2 emissions, reducing speed is one of the easier methods to do so (Bouman, Lindstad et al., 2017). Furthermore, a holistic coordination would enable an improved utilization of resources like berths or services (Lind, Lane et al., 2018).

The researchers involved in the PortCDM project suggest that in the long run, PortCDM can not only optimize port operation but also enable more advanced applications as shown in Figure 14. This could include support of cold ironing, i.e. onshore power supply or improving financial validation through providing a reliable and transparent system of records. The availability of a standardized data format could also be used by third-party developers to offer additional services, e.g. routing software which can use both data from PortCDM and external providers (Lind, Bergmann et al., 2019).

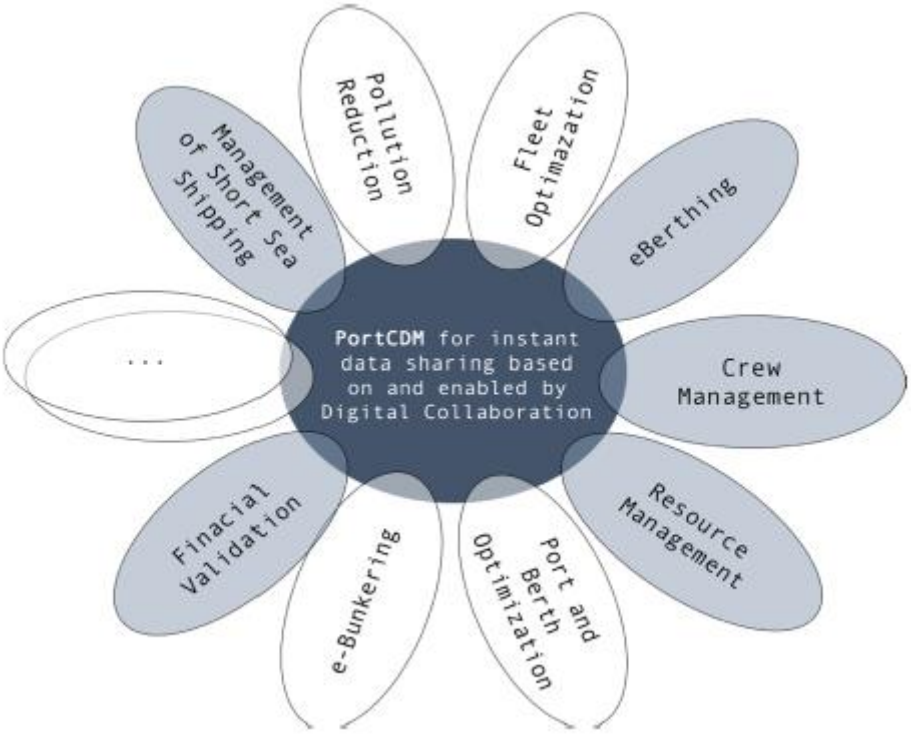


Figure 14 – Suggested Possible Applications Enabled by PortCDM (Lind, Bergmann et al., 2019)

During the validation process of PortCDM, a large amount of data was gathered and analyzed. These data included port calls in multiple European ports and by ships of various types and sizes. It showed that the operational efficiency while in port varies, depending on the ship type. Passenger and Ro-Ro ships had the highest efficiency, as shown in Figure 15 (Lind, Haraldson et al., 2019).

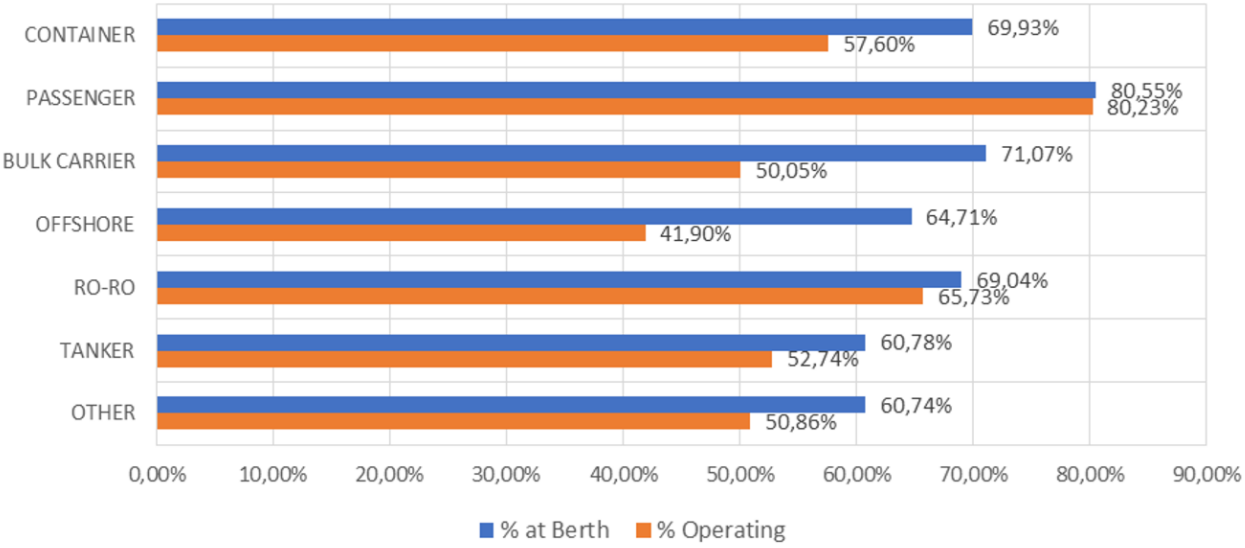


Figure 15 – Different Ship Types and Time Spent at Berth and Operating (Lind, Haraldson et al., 2019)

Another finding was that the predictability of processes during a port call generally decreases during the port call process. Predictability in that context is defined as "the degree to which a correct prediction or forecast of a state can be made" and being defined as:

$$PRED_{RAPP} = 1 - (Deviation\ from\ actual\ /\ Time\ before\ actual)$$

In other words, in case of a schedule change, the earlier the schedule change is announced before the actual change, the higher is the rate of predictability. Looking at the results, the predictability is highest during arrival at the traffic area (approx. 87%) and decreases to its low mark during the departure at the berth (approx. 67%), increasing slightly afterwards during the departure of the traffic area (approx. 72%) (Lind, Haraldson et al., 2019).

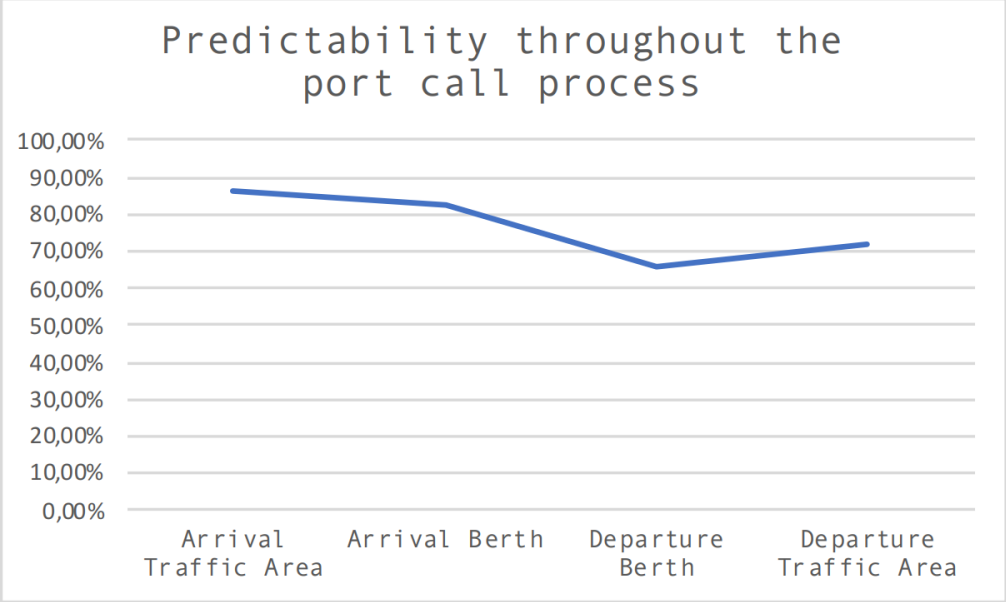


Figure 16 – Predictability in the different stages of the port call process (Lind, Haraldson et al., 2019)

2.4.4 The STEAM Project

Sea Traffic Management in the Eastern Mediterranean (STEAM) is a regional continuation of the EU-funded STM Validation Project with the general objective to ensure efficient management of sea traffic in the eastern Mediterranean Sea. This is to be achieved by an increase of real-time awareness through data sharing within the maritime cluster of Cyprus and the eastern Mediterranean region. Furthermore, a notable objective of the project is to develop the port of Limassol to become a world-class information and transshipment hub that drives short sea shipping in the eastern Mediterranean by enhancing services based on a standardized connectivity between actors (STEAM, 2019).

STEAM is spearheaded by the Cyprus University of Technology and co-founded by the EU and the Republic of Cyprus through the Research Promotion Foundation. Collaborative participants in the project include, amongst others the Research Institutes of Sweden (RISE), Cyprus Shipping Association (professional forum for the shipping agents of Cyprus), Cyprus Port Authority, DP world (general cargo and cruise terminals), EUROGATE Limassol Container Terminal, P&O Maritime (port and marine services), TOTOTHEO maritime (maritime technologies) and DELEVANT (business solution and analytics tools) (STEAM, 2019).

The project is structured to bring together expertise from all relevant stakeholders in the local maritime sector to drive innovation forward in interactive settings called Living Labs. These are designed to ensure stakeholders of different backgrounds to communicate with each other to find solutions that benefits everyone. Including expertise from all members of the maritime sector, researchers, local companies, public authorities and civil societies is considered key to harmonizing the innovation process to benefit the common needs (STEAM, 2019).

Being a regional continuation of the STM project, STEAM is based on the core PortCDM concept. Optimization of port call operations within the ports of Limassol is to be achieved by a collaborative decision-making

platform, extended to allow offerings of online services to integrated parties. A vision of the project is for PortCDM connectivity through the S-211 standard to be enhanced with other port-related systems, online interfaces and new services for collaboration between ports. Examples of the envisioned incorporation of other technological solutions include AIS (Automatic Identification System) tracking of ships movements, tracking of cargo and feeds of environmental oceanographic and meteorological data into the common platform. Such a platform of integrated data would allow for opportunities to analyze and benchmark operations, track KPIs and create new tools and services to support decision-making (STEAM, 2019).

2.5 Research Methods

2.5.1 Basics of Quantitative Data Analysis

Secondary data can stem either from other researchers or from organizations in the course of their operation and can be both quantitative and qualitative. Such analysis can be, but doesn't need to be, directly linked to what the data collectors envisaged during the data collection (Dale, Arber et al., 1988). Secondary data can also be combined with primary data to compare or verify findings (Bryman & Bell, 2015). Such data brings various advantages and disadvantages. As organizations tend to have resources available for data collection processes, the quality of the data is usually high due to established procedures and the data volume can be considerable. Secondary data analysis also presents the opportunity of cross-cultural analysis which would include using data from two different countries which would be difficult to gather alone (Bryman & Bell, 2015). While the cross-cultural analysis usually refers to different geographical regions, this would apply as well to different business areas in an industry as different business habits and values can be described as culture as well (Shani, 2009). Use of secondary data also saves time for the researcher and a reanalysis may offer new findings compared to the original analysis, be it due to different research methods or due to the arrival new theoretical ideas. However, there are also various challenges and downsides to secondary data. A researcher may not be familiar with the data, its structure and its range of variables. Therefore, a certain amount of time has to be invested to become familiarized with the data, which can become substantial in case of complex data sets. Even after familiarization, the complexity of the data may be an issue. Complex data may be organized in hierarchical data sets on multiple levels, and researchers must decide which and how many levels he will use for his research. Additionally, the researcher has little control over the data quality, especially when the original data collector has a different objective in mind than the researcher. Not being involved in the collection process makes it also harder for the researcher to detect faulty data. Furthermore, when relying on certain variables, there is little assurance that such key variables are included in the secondary data (Bryman & Bell, 2015).

Quantitative data can consist of different variables. These variables can be categorized in four areas:

- Interval/ratio variables – variables ordered by rank where the distances between the categories are identical across the whole range of categories. Examples include age or distances since the unit of a year or a meter are valid, no matter the amount. While ratio variables describe whole units, interval variables may describe partial units such as 2.5m.
- Ordinal variables – variables which can be rank ordered, similar to interval ratio variables, but the distance differs across the categories. Examples include age groups like "under 18/18-65/65+" or "daily/weekly/monthly"
- Nominal variables – categories which cannot be rank ordered. Examples include food categories like "fruit/vegetables/dairy"
- Dichotomous variables – categories which cannot be rank ordered and have only one interval. Examples include "Yes/No"

There are different approaches to analyze such variables. Analyzing one variable at a time is referred to as Univariate analysis. This may be done using frequency tables or diagrams, showing percentages or distribution of a variable. When applying this to an interval/ratio variable, these usually have to be grouped. Common diagrams for nominal or ordinal variables are bar diagrams or pie charts, while a histogram is more useful for interval/ratio variables. Additionally, various calculations can be made to detect averages or dispersion. The analysis of two variables is called a bivariate analysis and aims mainly at detecting whether there is a relationship between those variables. This can be achieved by various means. A simple method would be a contingency table which pairs two variables, although the effectiveness depends largely on the nature of these variables. Analyzing three or more variables simultaneously is referred to as multivariate analysis, which is however highly complex and may not be applicable to this thesis (Bryman & Bell, 2015).

2.5.2 Basics of Qualitative Analysis

Qualitative data such as transcripts from interviews are usually a large amount of unstructured text. Therefore, it is difficult to apply a straightforward methodology with clear rules as in quantitative data analysis. Saunders, Lewis et al. (2016) name three important processes for a qualitative analysis: summarizing, categorization and structuring. This is done to recognize relationships, develop propositions and to come to reasonable conclusions. There are two common approaches to analyze qualitative data, *analytic induction* and *grounded theory*. Analytic induction is defined as "*an approach to the analysis of data in which the researcher seeks universal explanations of phenomena by pursuing the collection of data until no cases that are inconsistent with a hypothetical explanation*" (Bryman & Bell, 2015). This analysis is work-extensive and demanding since any inconsistency in the data requires a re-formulation of the hypothesis.

Analytic induction has been largely replaced by grounded theory which is defined as "*theory that was derived from data, systematically gathered and analyzed through the research process. In this method, data collection, analysis and eventual theory stand in close relationship to one another*" (Bryman & Bell, 2015). The theory is generated by coding, i.e. by categorizing patterns and concepts found within the qualitative data. During the analysis of the data, the coding is continuously revised and reorganized. Corbin and Strauss (2008) define three approaches to coding:

1. Open Coding: "*the process of breaking down, examining, comparing, conceptualizing and categorizing data".* This is the first step in generating a theory and involves conceptualizing data which is later grouped into categories.
2. Axial Coding: "a set of procedures whereby data are put back together in new ways after open coding, by making connections between categories". This links codes to other codes, contexts or causes.
3. Selective Coding: "the procedure of selecting the core category, systematically relating it to other categories, validating those relationships, and filling in categories that need further refinement and development". This is done when a central theme emerges to which all data fits.

Another approach is the *content analysis* which can be used for both quantitative and qualitative analysis of documents. The former aims to quantify elements of the analyzed content, e.g. through word frequencies, while the latter aims to create a categorization scheme which groups relevant content by different criteria. Many variants of qualitative content analysis exist (Schreier, 2014). One approach by (Kuckartz, 2012), the *structured qualitative content analysis*, describes a categorization process as follows:

1. Develop main categories based on research objective/ interview structure
2. Mark and group relevant content within the data
3. Identify subcategories inductively
4. Compare content with main and sub categories
5. Modification of categories

6. Code remaining data with modified categorization scheme
7. Visualization of results, interpretation, discussion of research objectives

The emerging categories should relate closely to the research subject and should not be too detailed nor too general. (Kuckartz, 2012) names as recommendation a number of 10-20 subcategories. Some steps may be repeated during the analysis process to improve the quality of the categories. In contrast to grounded theory, this approach includes both deductive and inductive elements.

3 Research Methodology

This chapter describes the research strategy and ethics as well as the methods for data collection and analysis. This includes review of pertinent literature, a secondary quantitative data set and eleven semi-structured interviews.

3.1 Research Strategy

The answer to a question can be arrived from both deductive or inductive processes. A deductive approach typically poses a hypothesis and uses collected data to test the hypothesis. An inductive approach employs existing data to form a question for analytical consideration (Ruane, 2016). This thesis followed an inductive approach to examine if and to what extent PortCDM can be deployed in the cruise industry.

The thesis used various methodological approaches. First, a literature review was conducted to gather background information about the cruise ship industry, its actors, structures and processes, as well as existing communication and data sharing systems, including port information sharing systems and functions. Second, a quantitative data analysis of a database of cruise ship schedule deviations was conducted to gain insight into what logistics issues were common in cruise ship operations. Third, interviews were conducted with several industry stakeholders involved in both cruise ship port calls and the research of data sharing concepts in the maritime sector. These interviews were done to gain further detailed insight about port operations and the potential use of a concept like PortCDM. Additionally, as the data set from the quantitative analysis had various limitations, its findings were checked and verified in the interviews.

3.2 Collection of Pertinent Literature

A literature review was conducted using search engines like Web of Science, Google Scholar and the library portal of Chalmers University. Keywords were selected by their relevance to the thesis topic. Examples included “Port call efficiency”, “port data sharing”, “JIT operation” and “Cruise PortCDM”. Sources were mainly secondary sources. While there are many papers available on the topic of the maritime industry from various perspectives, there was little on the specifics of the cruise industry and even less on cruise ship port calls and operational efficiency.

3.3 Quantitative Analysis

3.3.1 Secondary Data Set

A secondary data obtained from a cruise company was analyzed within this thesis. The data set consisted of incidents of cruise ship port calls which resulted in delays of more than one hour (hereinafter referred to as “incidents”). The data was provided by a major cruise company and was compiled by the company over three years (2016-2018) and was reported for 38 ships. This amounted to 1648 recorded incidents. The ships operated worldwide with different itineraries. The data were entered by company personnel in a pre-defined table with multiple categories describing cause, nature and impact of the respective incident. Multiple data collectors were active in entering the data. These persons used a common guideline to enter the data which included the definitions of the below categories. The data were structured in tabular form with various columns. The data contains both fields with predefined values and free text and contains therefore both quantitative and qualitative data. Most entries are quantitative and are either interval, nominal or dichotomous variables. An anonymized example is shown in Table 2.

Table 2 – Anonymized Example of Data Structure

Column	Column Title	Content	Description
A	Date	*(Date)*	Showing the date of the incident

B	Cancelled, Missed or Delayed?	*Cancelled/ Missed/ Delayed*	• Cancellations: incidents where the ship's schedule is changed one week or less prior to the departure of the cruise, i.e. leaving the home port after a passenger exchange, due to known issues. Examples: security concerns, outbreak of diseases in that port. • Misses: incidents where unforeseen circumstances arise after the cruise has started that prevent the ship from calling on that port. Examples: technical failure, bad weather. • Delays: incidents where arrival or departure is delayed more than 1hr from the original schedule, unless this was planned accordingly before the departure of the cruise, i.e. before leaving the home port.
C	Brand	*(Company Sub Brand Name)*	Describing which brand the affected ship belongs to
D	Ship	*(Ship Name)*	Stating the name of the affected ship
E	Port	*(Port Name)*	Stating the name of the affected port
F	Port Type	*Transit Port/ Home Port*	• Home Port: the port where the cruise begins and/or ends, and typically the port where most passengers depart and arrive. • Transit Port: any port called in between Home Ports.
G	Arrival/Departure (if delay)	*Arrival/ Departure*	Only applicable with Column B = "Delays". Stating if the delay occurred during arrival or departure.
H	Time of Delay (if delay)	*(number of hours)*	Only applicable with Column B = "Delays"
I	Planned Length of Call (if delay)	*(number of hours)*	Only applicable with Column B = "Delays"
J	Replacement Port	*(Replacement Port)/ No Replacement Port*	Only applicable with Column B = "Cancelled"/"Miss". Stating whether a replacement port was used in Cancellations/Misses, and if so, stating the name of the port.
K	Reason	*Technical/ Weather/ Security/ SAR/ Medical Emergency/ Public Health/ Port Logistics & Operational/ Other*	Stating one of eight predefined reasons for the incident • Technical –failures or maintenance to the ship main machinery and auxiliary services • Weather –adverse weather conditions such as high winds, sea swells, restricted visibility, ice concentration, etc. • Security –security concerns such as political/social unrest, pirate activity, travel warnings, etc. • Search & Rescue (SAR) – ship's participation in search and rescue operations, man overboard, missing persons. • Medical Emergency – medical evacuation of onboard passenger or crew.

			• Public Health – outbreak sanitation procedures or Public Health inspections or detention. • Port Logistics / Operational – disruption in port activities such as port labor strike, delay of embarkation/disembarkation, provision or luggage, port traffic, pilots, delay in tours, delayed flights, tender operations, Port State Control, CBP inspections, bunker operation, etc. • Other – any deviation that does not fall into the above categories (e.g. charter request, non-technical diving operations, IT issues).
L	Impact on Shorex	*Unknown Impact on Shorex/ No Impact on Shorex/ Impact on Shorex*	Describes if shore excursions sold by the company to the passengers are affected by the incident.
M	Other Impacts/Comments	*(Free text & further description)*	The only column containing free text & more detailed information on the reason of the incident and possibly additional impacts, e.g. documented guest dissatisfaction.

Data from columns C/D/E was not used to comply with the confidentiality agreement signed with the company providing the data.

There were several limitations within these data:

- The data showed only incidents which resulted in delays of more than one hour. Delays of less than one hour were disregarded, the same for schedule deviations which resulted in earlier execution of a planned event.
- The free-text field in column M showed different wordings for similar situations. An example includes “Bunker boat late”, “Bunker Ops” and “Delay of barge” for three different incidents. This made it difficult to group incidents based on the free-text field and analyze the reasons for the incidents.
- Despite the long collection period, some incidents happened very rarely, such as incidents due to Search and Rescue operation (SAR). This makes it difficult to analyze the actual impact of such incidents.
- The original itineraries of the ships were not available, and it was therefore neither possible to analyze geographical distribution of the incidents nor to quantify the exact incident rate.

The latter was done instead by analyzing a number of 40 publicly available cruise ship itineraries and calculating the mean number of port calls per year against the number of ships monitored (Appendix 7.4).

Multiple incident notations included minor errors. This included misspellings, cells left blank, double entries, contradicting information and ambivalent categorization of incidents not clearly defined in the data collection guideline. An example of the latter included categorizing tidal issues as both “Other” and “Port Logistics & Operation” in two separate cases. In almost all of these cases, it was possible for the researchers to correct the data according to the overall context. This was not the case in mismatches in column L, the impact on shore excursions. In those cases, the researchers assigned “Unknown”. Overall, the occurrence of errors was low and while resulting in additional effort in cleaning the data, it can be assumed that these

errors did not influence the quality of the data. A detailed description of assumptions used in cleaning the data is found in Appendix 7.3.

3.3.2 Steps in Analyzing the Data

Data reduction and preparation considered the following questions:

1. What situations are common for disturbances resulting in delays >1hr?
2. Which situations have a strong impact
    a. In financial loss?
    b. In impacting customer satisfaction?
3. What situations could potentially be improved with better data sharing?

For the first question, incidents which resulted in delays were separated in delays at arrival and departure. The incidents were then categorized by Misses, Cancellation and Delays (Arrival) and Delays (Departure). These categories were included by column K.

Questions 2a & 2b were difficult to answer since none of the entries stated explicitly quantified financial loss or customer dissatisfaction. Therefore, four variables were identified which were assumed to have an impact on 2a and/or 2b.

- Column H describes the duration of the delay. This would require both additional coordination of all involved actors during the port stay and, in case of delays at departure would lead to a higher required speed to the next port, resulting in higher fuel consumption and therefore a negative economic and environmental impact.
- Column F describes whether an affected port is a transit or a home port. As a home port is where both most passengers embark/disembark, any disturbance may result in passengers missing transport connections or having a bad impression on their first/last day. Additionally, various services like provision or garbage disposal are often scheduled for that day. Therefore, any disturbance affecting a home port is more negative both financially and in terms of customer satisfaction than a transit port.
- Column L describes whether an incident affected shore excursions sold by the company. If that is the case, passengers and tour operators would have to be reimbursed financially or, in case of delayed arrival, the overall laytime could be extended which would lead to delay at departure. Therefore, any disturbance affecting shore excursions is leading to negative economic, environmental impact and/or negative customer satisfaction.
- Column J describes whether a replacement port was used in case the original port was cancelled/missed. Since number and selection of ports are important factors for generating revenue and customer satisfaction, removing a port from the schedule without any replacement port can be assumed to be negative and finding an appropriate replacement port would be more desirable.

It was found that the original data were insufficient to deliver suitable results for Question 3. Column K ("Reason") did neither distinguish between intended or unintended deviations, nor between the number of involved actors. As an example, this resulted in unscheduled delays due to late shore excursions and scheduled delays to watch a local firework being both assigned to the PL/O category. This made it difficult to filter the data. Therefore, to evaluate the level of applicability of enhanced data sharing, a "Data Sharing Potential" (DSP) factor was created and assigned to every incident. This factor has a range from 1 to 4, whereas 1=low, 2=fairly low, 3=fairly high and 4=high. The aim was to show if an incident can either be avoided and/or if its negative impact can be diminished with an improved data sharing structure. This approach was chosen in order to include incidents where the likely root cause, such as weather, could not be avoided, but where the consequences, such as rerouting or informing all involved actors in a short time about the deviation, could be mitigated with enhanced data sharing capability.

To assign the DSP factor in a systematic way, the incidents were divided into new subcategories based on the following factors:

4. Short- or long-term schedule deviation
5. Intended or unintended schedule deviation
6. Level of coordination and number of actors involved
7. In case of delays due to PL/O, a further specification of actors involved in the root cause, if specified in the data set

Short-term deviations, unintended deviations or deviations involving entities in addition to ship and port actors were assigned a higher DSP factor, assuming that such situations have an increased requirement of exchanging a lot of information in a short time. Delays at arrival and departure were divided depending if they were caused by or were impacting operation with third parties, i.e. actors other than the ship and the port. For delays at arrival, this was done by sorting the incidents by their impact on shore excursions (Shorex), as it can be assumed that such an incident has an overall strong impact on the operations scheduled during the port call. If the incident stated “Unknown impact on Shorex”, an impact on operations was assumed if the delay was >3hrs. For delays at departure, the description in “Other Impacts/Comments” was analyzed to find if parties besides ship/port were included. As PL/O incidents were the second most common category overall and these incidents would be very interesting in the context of a ship-port data system, these incidents were specified further. Following these criteria, 17 categories were created, and a DSP factor was assigned to each category.

Additionally, two categories were created which fell outside these criteria:

8. Delays due to tender operations were sorted in the category Tender Operations, as these are usually performed when a ship is at anchor. As this eliminates the need for linesmen or tugs, a lower DSP factor was assigned than to the other PL/O related incidents.
9. Any incident which was described as being the direct result of a delayed departure from the previous port or delayed arrival at the same port was sorted in the category “Previous delay”. Although the reasons for that previous delay differed, it could be argued that such chain of incidents offer opportunities for data sharing, most specifically between departure port and arrival port.

The resulting 17 categories were sorted, and a DSP factor was assigned (Figure 17). A more detailed description of the categories is in Appendix 7.5.

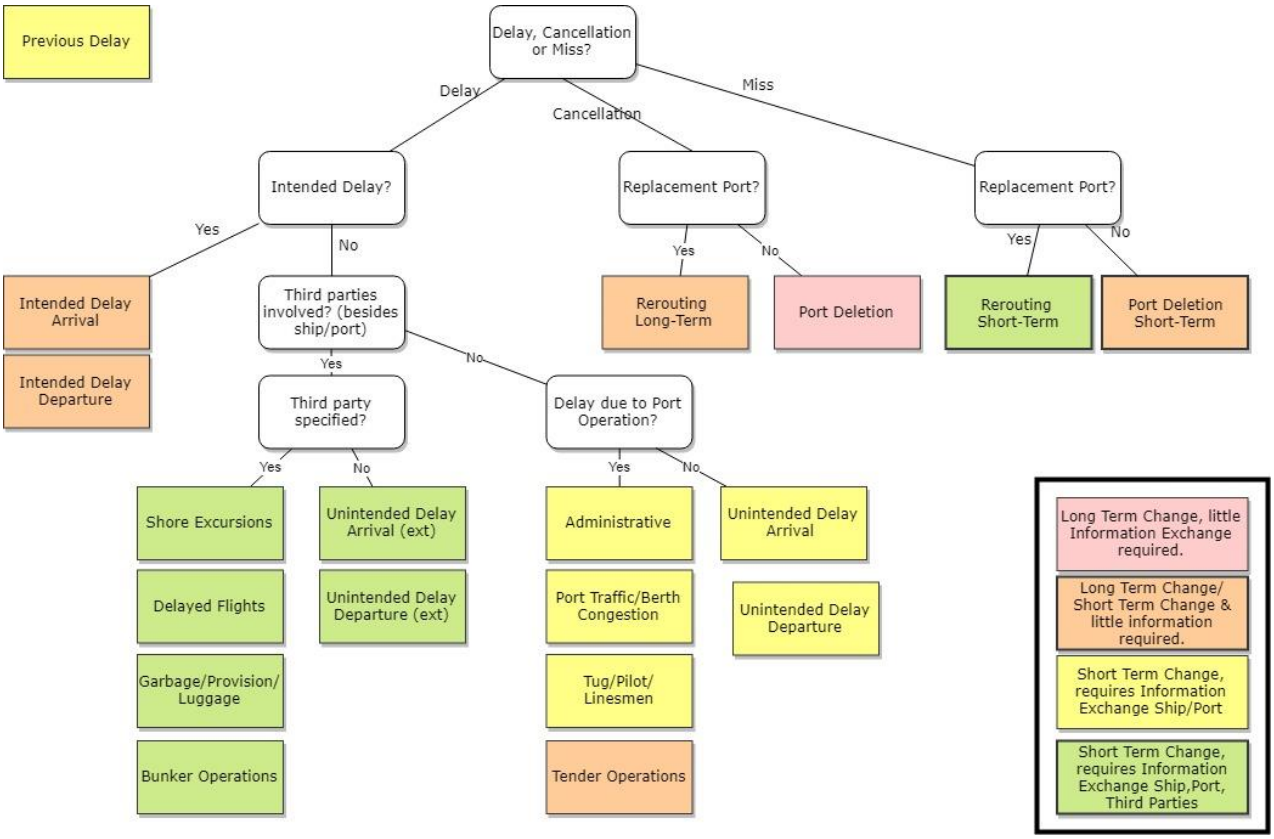


Figure 17 – categorization scheme of DSP subcategories

3.4 Qualitative Analysis

3.4.1 Interview Preparation

Multiple semi – structured interviews with various actors involved in the port call process of a cruise ship were conducted. The findings from the literature review and the quantitative data analysis were important foundations for the interviews. At the same time, it was important to present those findings in a sensitive manner and not to influence the interviewees' stance. Therefore, the interviewees were provided with information regarding the thesis topic, the interview questions and basic information about the PortCDM concept. This allowed interviewees to familiarize themselves with the overall topic and potentially prepare answers.

Additionally, four example scenarios were created to help with the verification of the quantitative analysis findings. The scenarios were based on the three main areas of possible benefit for improved data sharing found in the data analysis in 2.1. The scenario "Delay at Departure" was divided into two slightly different scenarios to cover possible delays both in a Transit Port and a Home Port. The schedules are based on common itineraries used by cruise ships operating in Northern Europe (Crew Center, 2018). The time of delay for scenarios II, III and III.I were assumed based on the median time of delay for such occasions found in 4.1.3.1. The scenarios are:

I. Rerouting due to strong winds
II. Delayed Arrival due to port traffic
III. Delayed Departure due to delayed flights of passengers
III.I Delayed at departure (late passenger embarkation).

A more detailed description of the example scenarios is shown together with other information provided to the interviewees in Appendix 7.7.

3.4.2 Interviewee Recruitment & Demographics

Interviewees were active or recently active professionals involved in activities related to cruise ship port calls, including active cruise ship company personnel working in the office and onboard, port personnel and shipping agents. In addition, two researchers working on data sharing concepts in the maritime sector were interviewed. Interviewees were contacted via mail and social networks. Prior to the selection of interview participants, multiple actors were engaged in informal discussions of 45m - 1,5h, including the majority of actors subsequently interviewed. The discussions provided thematic guidance to the thesis process by providing valuable information regarding potential sources and laid the foundation for the recruitment of interviewee participants.

Although the aim was to have a geographically and culturally diverse sample of interviewees, the final selection shows a strong focus on interviewees in the Scandinavian region. This was because the response rate of possible interviewees outside of Scandinavia was poor. All interviewees were assigned a code to maintain confidentiality. The interviewees and description of their role are in Table 3:

Table 3 – Interviewee Overview

Code	Organization	Role	Type of Interview
PR1	RISE	Researcher	Phone
PR2	Cyprus University of Technology	Researcher	Phone
PC1	Major Cruise Line	Shoreside Operation & Monitoring	Phone
PC2	Major Cruise Line	Director Security	Phone
PO1	Major Cruise Line	First Purser (formerly)	Phone
PO2	Major Cruise Line	Captain	Phone
PP1	Port A (Scandinavia)	Cruise Manager	Face-to-Face
PP2	Port B (Scandinavia)	IT Coordinator	Phone
PP3	Port C (Scandinavia)	Cruise Manager	Phone
PP4	Port D (Scandinavia)	Cruise Manager	Phone
PA1	Shipping Agency (Scandinavia)	Director (PA1a) & Operations Manager (PA1b)	Phone

3.4.3 Interview Structure

There were three main objectives in these interviews:

1. Derive insights of interviewee's operation and issues/problems
2. Record opinions of interviewee on possibilities and potentials of enhanced data sharing concepts and PortCDM
3. Verify findings of literature review and quantitative data analysis

The interviews were conducted with an exploratory approach and in a semi-structured format. Suggestive speech and closed – ended questions were avoided as they are inefficient interviewing tools and give little

information (Saldaña, Leavy et al., 2011). Therefore, the focus was on asking open questions following the interview structure**,** giving the interviewee time to talk and then probing into the responses. The topics covered included the interviewee's role in a port call process of a cruise ship, relevant communication processes, means used within these processes, arising issues and possibilities to mitigate such issues with enhanced data sharing capability. The findings of the literature review and the quantitative data analysis were presented in the last part of the interview in order not to influence the interviewee (Table 4). The duration of the interviews was approximately between 30-45 minutes, with one interview being 85 minutes. The interviews were recorded by audio recorder and then later transcribed (Appendix 7.8).

Table 4– Interview Structure

Topic	Question
0.1 Formalities	Permission for recording and citation Publishing of thesis & confidentiality Encouraging to speak up if the interviewee feels at unease
1.1 Status Quo	Interviewee's role in cruise ship port calls Methods of coordination
1.2 Issues	Major challenges/issues in the port call of a cruise ship
	Quality/Efficiency of communication in such situations
	Importance of various collaboration areas
1.3 Other	Other situations requiring a lot of coordination/collaboration
2.1 Enhanced Collaboration	Interviewee's thoughts on port collaboration concept
	Potential/challenge in such a system?
2.2 Possible Application	Interviewee's thoughts on how to utilize such enhanced data sharing capability Required information content Possible use for issues mentioned before
2.3 Possible Use of PortCDM	Potential value for operation
	Interviewee's view on how to potentially utilize PortCDM
2.4 Application Areas	*(If topics have not been brought up before)* Interviewee's opinion on PortCDM application in:
	○ Coordination in normal operation
	○ Coordination in case of schedule deviations
	○ Avoiding issues which lead to schedule deviations
	○ Long-term planning
	○ Building your overall operational capability
	○ Collecting data for internal use & performance monitoring
	○ (Interviewee's suggestion)
3.1 Verification of previous findings	During this thesis, we analyzed a data set of cruise ship port calls and found three recurring incidents which could benefit from an improved communication system: *1. Port Cancellations and subsequent rerouting* *2. Delays at arrival impacting following port operations* *3. Delays at departure due to third parties* *(refer to example scenarios)*
	Interviewee's thoughts on those findings
	Interviewee's work steps in such incidents
	Impact of such incidents
	Potential use of PortCDM for such incidents
4. Outro	Any further comments
	Possibility to contact for further questions/short post-interview questionnaire

3.4.4 Steps in Analyzing the Interviews

Interviews were transcribed either manually or by using the voice-to-speech function of the online service "Google Docs" (https://docs.google.com), mistakes were corrected where necessary. Informal or broken speech were ignored. Names, locations or anything which could reveal the interviewee's identity were left out or paraphrased, e.g. by "(company)". Certain parts which were included in most interviews were summarized, such as the introduction and description of the findings of the quantitative analysis. Afterwards, the transcripts were imported in the qualitative analysis software program NVivo 12 Pro (Version 12.3.0.599, distributed by QSR International, downloaded via the Chalmers University Software Portal).

Initially, a grounded theory approach by (Corbin & Strauss, 2008) was chosen to analyze the data. However, early in the analysis, it became clear that the idea of building a core concept, the result of the selective coding process in grounded theory, did not match the research objectives of this thesis. A more suitable approach was found in the structured qualitative content analysis described by (Kuckartz, 2012). As result, the data was analyzed using a mix of deductive and inductive categorization, incorporating elements from both grounded theory and structured qualitative content analysis. Main categories were developed deductively based on the structure and objectives of the interviews. This matches the first step of the structured content analysis as described in Section 2.5.2. Initially, three main categories were chosen mirroring the interview objectives. This was later expanded to six due to the large amount of content.

To create sub-categories, an inductive approach including open and axial coding from grounded theory was used. The open coding included repeated readings of the transcripts and an in-depth analysis of its content. The content was coded into various categories. This enabled an overview of the content and a constant comparison of data from subsequent interviews. In the axial coding, the categories were redefined or linked together and integrated into other categories. An example of this coding process is shown in Table 5 where various quotes are categorized into "Role of Agent" and "Potential Changes through Data Sharing" and subsequently integrated in the main category "Supporting Key Personnel". Selective coding was not used because the categories created through axial coding were seen as sufficient for structuring and analyzing content and identifying a core concept was not seen as necessary to answer the initial research objectives.

Table 5 – Example of Coding Process

Raw Data	Open Codes	Axial Codes
it seems like the shipping agent plays an important factor in all of this. (PR2)	Role of Agent	Supporting Key Personnel
communication with the shore Based Services like shore excursions are lines-man could be enhanced because right now this is all done by the agent. (PC1)		
It mostly depends on the agencies. (PO1)		
all information is going through the agent. (PP1)		
I see potential in better and fast communication, that makes the communication onboard easier, and with the people ashore. I think you can reduce the costs with the port agencies. (PO1)	Potential Changes through Data Sharing	
I (as agent) do like the idea of having an app sharing the information. We would have to come up with notifications and people would have to get used to it (PA1b)		
The agent will probably have less work (…). If they are going to be protective (…) ships are going directly to the port and ask what services can you provide directly through PortCDM? (PP2)		
First of all, as always on cruise ship everything is about guest satisfaction. You want to have everything smooth. (PO1)	Passenger Satisfaction	Further Potential for Data in Tourism
or if we cut the port call short then of course it impacts guest satisfaction Also of course it has an impact on the shore excursions booked with the financial and guest satisfaction impact. I would say those are the main impacts. (PC1)		
how can we make it more comfortable for the passengers so we don't mix them with waste handling and so on. All this information can be much better if we have a common communication and a common planning platform. (PP1)		
You have public transportation, how can you interact with them in a good way, regarding environmental or safety issues (PP2)		

we have great network with the municipality and the tourist office and the shore excursion companies. We sit down several times before the season, during the season and after to evaluate. (PP4)	Cooperation Port - Municipality - Tourist Agencies	
We try to work very proactively. We have two debriefing meetings now about the traffic situation in the time, and how it will affect the tour buses (PP1)		

Additional elements central to grounded theory were adopted during the analysis process. Memos were taken after every interview, including information pertaining the interviewee and observations made during the interview. The data analysis was commenced after the first interview and continuously ongoing throughout the data collection process. Findings from previous interviews were highlighted in subsequent interviews to confirm or modify findings and to clarify uncertainties. An example includes interviewees PO1 and PC1 naming the varying performance of ship agents as a common issue. This topic was subsequently added to the interview structure for interview participants which interacted often with shipping agents. Data saturation was achieved when enough information was collected to answer the research objectives and no new codes emerged. The qualitative analysis resulted in 14 categories in total, being divided into six main categories. An overview of these categories is shown in Figure 18. This category is mirrored in the structure of Section 4.2.

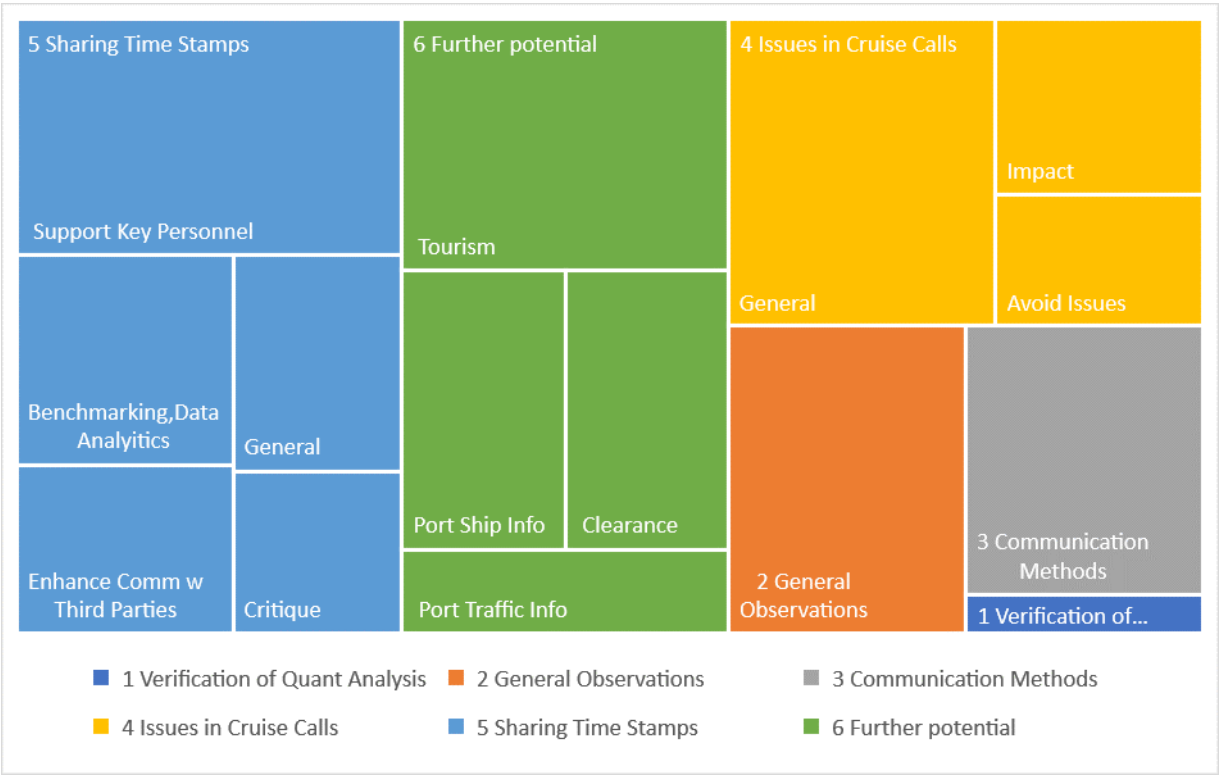


Figure 18 – Final Categories and Subcategories as Coding Result (size of boxes equals number of references)

3.5 Research Ethics

For the quantitative data, a confidentiality agreement with the company was prepared and signed which defined what data could be used and to what extent. This agreement included clauses stating that the data were not to be shared with third parties and that the company could see the thesis before publishing.

For the interviews, permission for recording the interview was asked and anonymity was assured. It was important to show the interviewee before and during the interview that the interviewers had a neutral

stance regarding data sharing and the different technologies, specifically PortCDM, and would avoid passing any judgement on to the interviewees' answers. The interviewee was encouraged to speak up in case an impression that mutual trust is broken. After the interviews, the respective transcript and the data presented in Chapter 4.2 were sent to each interviewee to make sure no quotes were not taken out of context.

4 Results

This section presents the findings from the quantitative and qualitative data analysis.

The quantitative data analysis is divided into an overview, general findings on operational efficiency, impact of schedule deviations, how enhanced data sharing can potentially mitigate schedule deviations and a summary.

The qualitative data analysis is divided into an overview, the verification of quantitative analysis findings, general observations, communication methods, issues in port operation, the potential of sharing timestamp data and further potential use of data.

4.1 Quantitative Data Analysis

4.1.1 Overview

The data set showed that cruise ships experience delays or port cancellations in approx. 6% of all port calls. The most common schedule deviations were delays. Of those delays, ca. 70% occurred at departures and 30% at arrival. The second most common incidents were port cancellations during the cruise (called "misses" in this data set). Port cancellations before the cruise had started were the least common.

The most common reason for schedule deviation was weather, in most cases specified as strong winds. Second and third common are due to Port Logistics/Operational (PL/O) and Technical reasons. At delays, PL/O incidents have a significantly higher frequency than in cancellations/misses, with delays on departure being more affected than delays on arrival. The high number of delays at departure confirm the findings of the findings of the STM Validation Report described in Section 2.4.3, where it was found that the predictability during a port call is at its lowest in the stage of departing from the berth.

Due to limitations of the data set, it was difficult to specify the exact impact of the various incidents on revenue and/or customer satisfaction. Four variables were identified which may be assumed to have some impact: time of delay in hours, port type, impact on shore excursions, and whether a replacement port was included in case of cancellations/misses.

- In hours of delay, delays at arrival and departure had a similar average amount of 3,5h & 3,7h. Delays due to weather had a significantly higher impact and a higher standard deviation than other reasons, while the second most common reason PL/O had one of the lowest impacts as well as a low standard deviation. As delays at departure would lead to a higher required speed to the next port, an environmental impact can be assumed, although the scope of impact would depend on the length of the voyage and the resulting increase in the required speed.
- Home ports were rarely affected by cancellations/misses. Looking at delay, delays in home ports due to PL/O were above average compared to all incidents, likely due to the increased logistical effort.
- The analysis of impact on shore excursions (Shorex) suffered from a high number of entries which stated "Unknown impact on Shorex" which led to high uncertainty. Delays at arrival and delays of more than three hours suggest a higher impact.
- When a port was cancelled or missed, a replacement port was used in 69% of the cases. There was no significant difference in that rate whether the port was cancelled before or during a cruise. Cancellations/Misses due to PL/O had a higher chance of using a replacement port (82%), possibly because these events tend to affect only a single port and it is easier to find another port nearby.

To analyze the data sharing potential (DSP) in these incidents, a DSP factor was assigned to every incident based on various factors. Over 80% of all incidents resulted in having a "high" or "fairly high" data sharing potential. This was due to three main occurrences:

- Ships changed their schedule on a short notice, i.e. during the cruise, and rerouted to a different port.
- Ships experienced delays on arrival which had an impact on the port operation and therefore required re-coordination
- Ships experienced delays on departure which included parties besides the ship and the port, such as shore excursion operators, bunker barges or airlines/public transportation. Such delays occurred more often as well than delays at departure without the involvement of third parties.

Main issues in the port operation are poor port traffic /berth coordination or passenger-related operations like Flights and shore excursions. Additionally, 5% of all incidents were directly linked to a previous delay, often resulting in delays in the next port.

4.1.2 General

It was not possible to calculate the overall incident rate of how often delays or port cancellations occurred. This was because the original itinerary data of the ships recorded in the data set were unavailable. Instead, this rate was calculated using the itineraries of 40 randomly selected common-size cruise ships from major cruise companies for the year 2018. Analyzing these itineraries, a mean rate of 240 port calls per year was found (Crew Center, 2018). Assuming this rate is similar to the ships from the data set and knowing that the data set monitored 38 ships over three years, this results in an ¨estimated¨ incident rate of 6%. An overview of the analyzed itineraries and the calculation are shown in Appendix 7.6.1.

The overall distribution of incidents was determined. Looking at the reasons of the incidents, Weather and Port Logistics/Operations (PL/O) are the two major factors and account for 80% of all incidents combined. Technical comes third with 10%, Other and Medical Emergency make for 5% & 4% respectively, while the remaining incidents are due to Security, SAR and Health reasons (Figure 19).

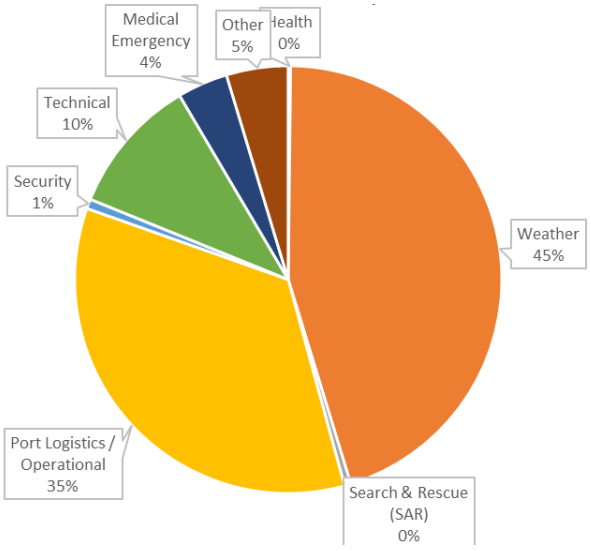


Figure 19 – Distribution of incidents by Reason/Column K

A deeper detailed assessment of this information in by both reason and cancellation/miss/delay at arrival/departure, described a more differentiated picture (see Figure 20).

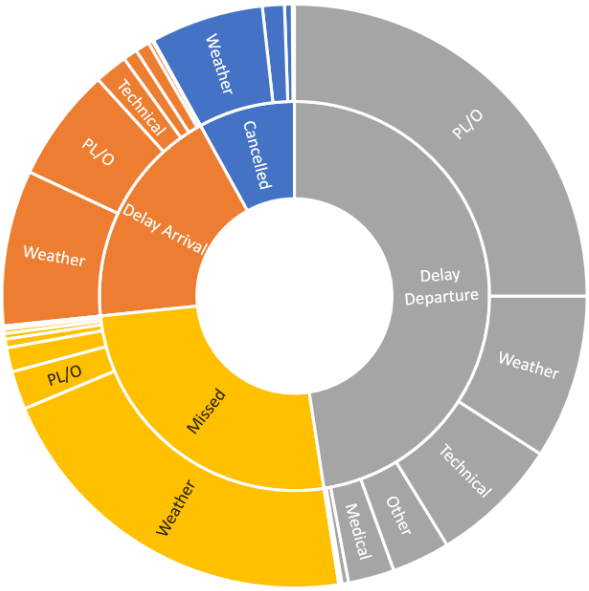


Figure 20 – Distribution of incidents by nature & reason

Delays at departure make nearly 50% of all incidents, with the respective main reason being PL/O with 53%, followed by Weather (19%) and Technical (15%). The second most common category was Missed, with the respective main reason being Weather (82%), and PL/O and Technical making only a small percentage (8% & 5%). The third common category was delays at arrival (19%) due to mainly Weather (46%), PL/O (34%) and Technical (10%). The smallest incident overall are cancellations (8%), accountable due Weather (78%) and PL/O (15%). Overall, the division of the incidents into cancellation/delay/miss mirror the major trends of Weather and PL/O being the major reasons. Cancellations and misses are mostly due to Weather issues, while delays happen more frequently and have more diverse reasons, mainly Weather, PL/O and Technical.

When looking at the number of incidents over time, it shows that incidents occur more often between October and March. However, due to the lack of the original itinerary data, this finding has little value since it is not clear whether the ships were operating on the northern or southern hemisphere (see Appendix 7.6.2).

4.1.3 Impact

The factors of time of delay, affected port type, impact on shore excursions and likelihood of finding a replacement port are analyzed to assess cost and passenger satisfaction impact of incidents.

4.1.3.1 Delays

Hours of delay were only recorded if the incident caused a delay at departure or arrival. Due to the low occurrences of incidents due to Security (n=7), SAR (n=6) and Public Health (n=1), these were excluded from this analysis.

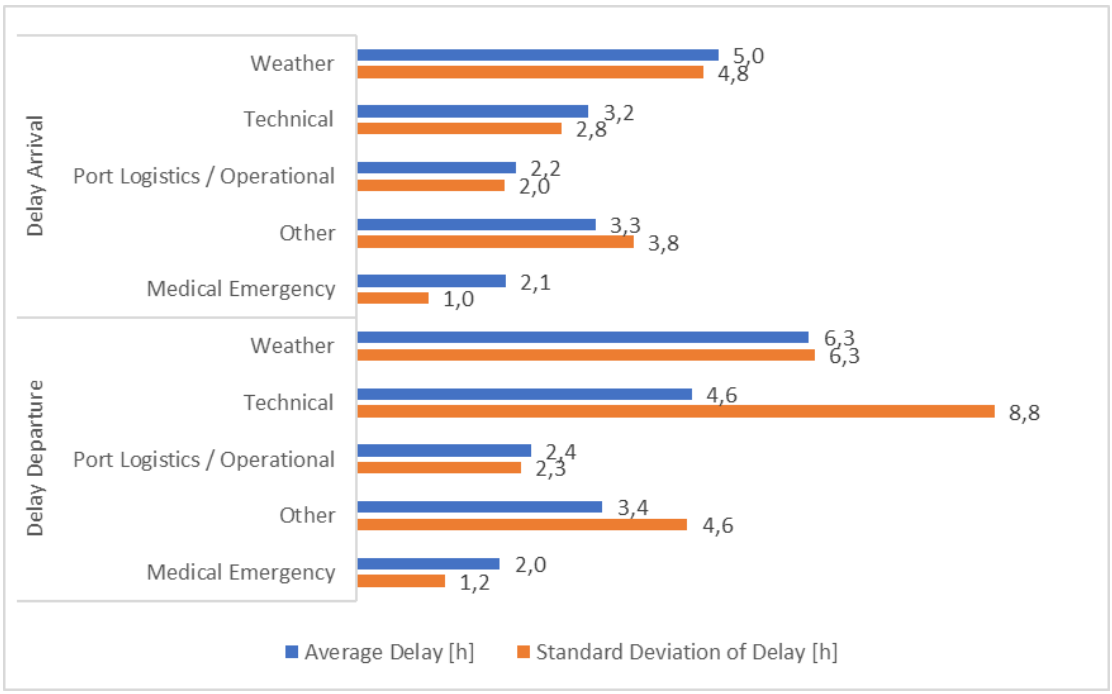


Figure 21 - Comparison of Average Delay and Standard Deviation of Delay at Arrival/Departure

Analyzing the average hours of delay, the overall average value is similar for both arrival (3,7h) and delay (3,5h) (see Figure 21). Weather had the highest mean values for delayed arrivals and departures with 5,0h and 6,3h, respectively. PL/O, being the second main reason at arrival and the main reason at departure. PL/O however is one of the lowest mean values (2,2h & 2,4h), together with Medical Emergency (2,1h & 2,0). The categories Technical and Other have values close to the mean at arrival (3,2h & 3,3h), whereas Technical is slightly above the mean at departure (4,6h) and Other, is again, close to mean at departure (3,4h).

Trends can be assumed when examining the standard deviations of the overall delay reasons. Incidents at departure tend to have a higher variation than the incidents at arrival. This corresponds to the findings of the STM Validation Report described in Figure 16 where predictability, i.e. the degree to which a correct forecast can be made, was shown to decrease during the port call. Non-controllable events (Weather, Technical) were also less predictable as shown by the high number of outliers (Figure 22).

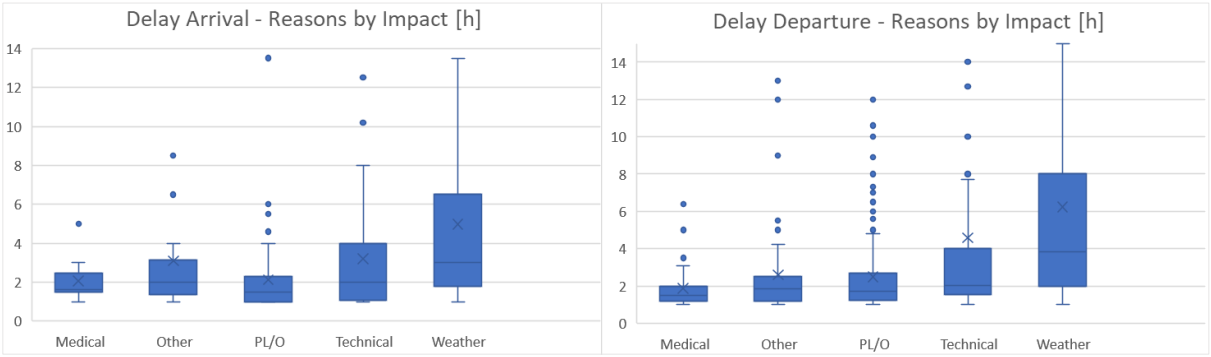


Figure 22 – Box and Whisker Plot of Delay in hours by Reason

4.1.3.2 Port Type

Of the 1648 incidents, the ships' home port was implicated in 474 cases (29%). It is not possible to recognize from the data how many port calls overall were in home ports and if 29% does fall under or over the average frequency of home port calls. It is notable that home ports are rarely cancelled or missed (1,3% & 2,3%)

which is very much below the general distribution seen in 7.6.3. Most incidents are delays which happened at arrival (24%) and departure (72%) of a home port (see Figure 23).

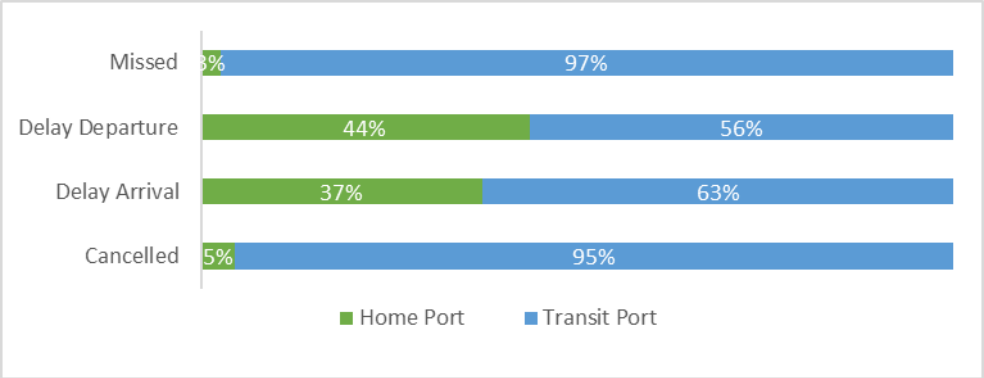


Figure 23 – Incidents affecting Transit and Home Ports

Figure 24 compares the distribution of all incidents in transit and home ports (excluding SAR, Security and Health incidents due to low occurrences). While the overall trends are similar, it can be noted that incidents due to PL/O are overrepresented in home ports (56% vs 27%). This may be due to the high logistic effort in home ports arising from the passenger exchange and supply deliveries. Weather incidents on the other hand are less frequent. A more detailed overview of these data is included in Appendix 7.6.3.

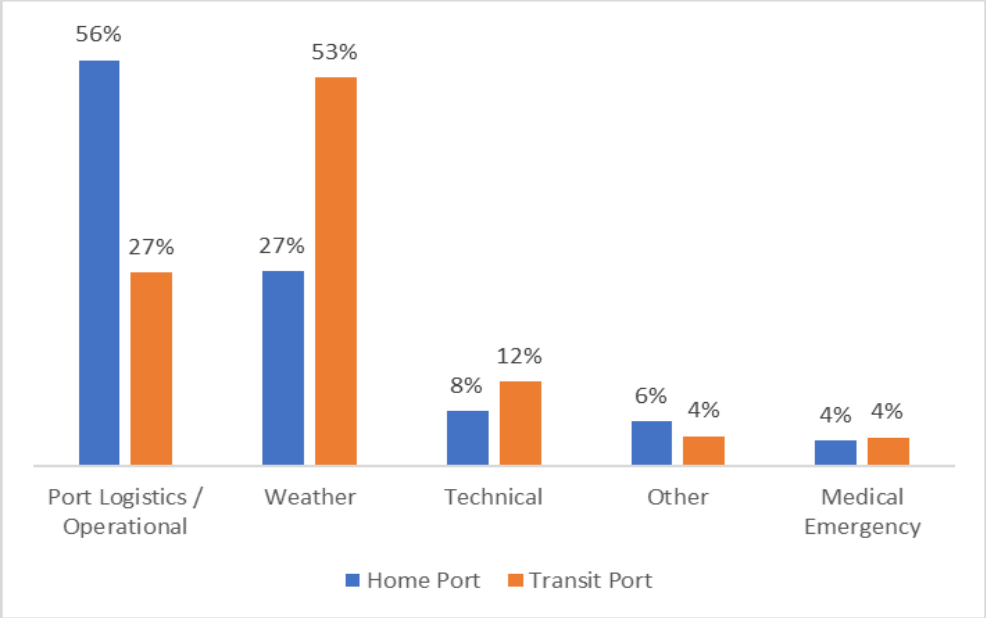


Figure 24 – Distribution of incidents in Transit and Home ports

4.1.3.3 Shore Excursions

The analysis of incidents where shore excursions were affected from a high number of entries stating "Unknown Impact" or entries which seem implausible. Examples include delays at arrival with >6 hours of delay and stating "No Impact". The data suggests that delays at arrival and with a delay of >3 hours tend to have a higher impact on shore excursions, which seems logical. A more detailed analysis is shown in Appendix 7.6.4.

4.1.3.4 Replacement Port

69% of all cancellations and misses were followed up with a replacement port, i.e. an alternative instead of the originally planned port of call. Cancellations have a slightly higher chance to have a replacement port than misses (73% & 68%). Given the fact that cancellations are defined as the decision to cancel a port

before the cruise has started and a miss as a decision to do so during the cruise, one would expect a bigger difference given the longer time to organize the rerouting in case of cancellations. Thus, it can be assumed that the re-routing process generally works out well irrespective of time, although this gives no indication about the required work amount (Figure 25).

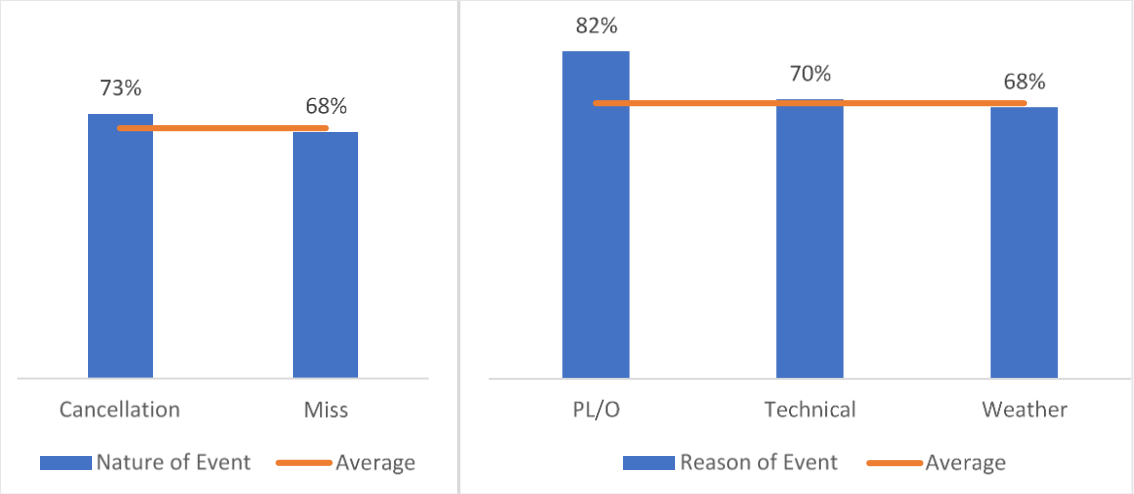


Figure 25 – Probability of finding a Replacement Port by Nature and by Reason of Incident (excluding reasons with <11 incidents)

Looking at the reasons, incidents caused by PL/O have a higher chance of being followed with a replacement port than incidents due to Technical/Weather. This seems plausible as technical malfunctions of onboard equipment or poor weather in a geographically large area would make it difficult to proceed to another port, in comparison with a PL/O incident like port strikes or port congestion.

4.1.4 Data Sharing Potential

The DSP factor was calculated by the methodology described in Section 3.3.2. Events were categorized by the number of involved parties, level of required coordination, whether the incident was planned and whether the incident occurred on a short or long-term notice. Four categories were generated, ranging from 1=low (Data Sharing Potential) to 4=high.

Most incidents have high or fairly high DSP factors, making almost 80% of all incidents combined. Fairly low DSP incidents make for 20% and low DSP incidents make only for 2%. A more detailed overview of the DSP distribution is included in Appendix 7.6.5.

Figure 26 – Distribution of Data Sharing Potential Factor

In DSP categories 3=fairly high & 4=high, the most common categories are the combined PL/O subcategories (21%), Rerouting Short-Term (17%), Unintended Delay Departure without (15%) and with (9%) external parties and Unintended Delay Arrival without (7%) and with (6%) external parties (Figure 27).

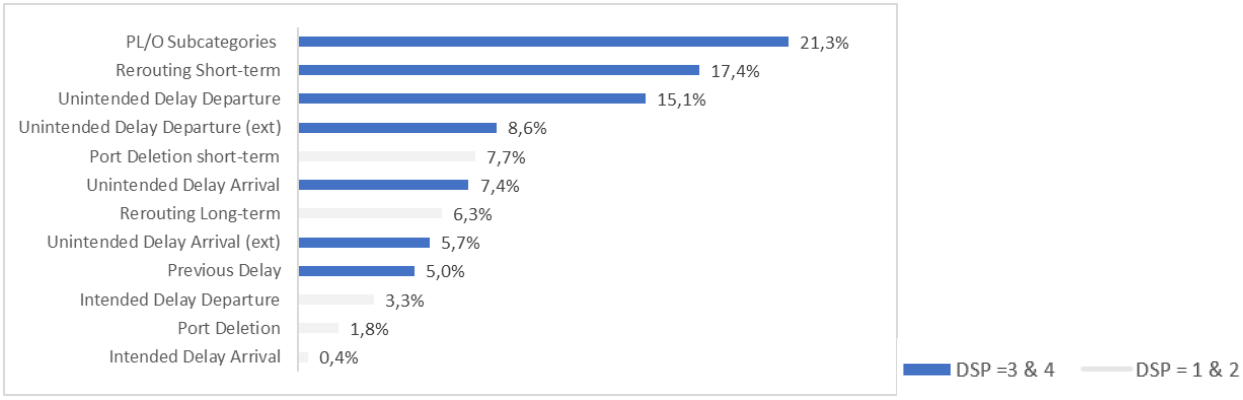


Figure 27 – Distribution of all DSP Subcategories, PL/O Subcategories combined

The most common issues in the port operation are Port Traffic/Berth Assignment (combined 30%), Delayed Flights (25%), Shore Excursions (15%) and Bunker Operation (12%) (Figure 28). Further, most issues in the port operation occur at departure rather than at arrival (Figure 44).

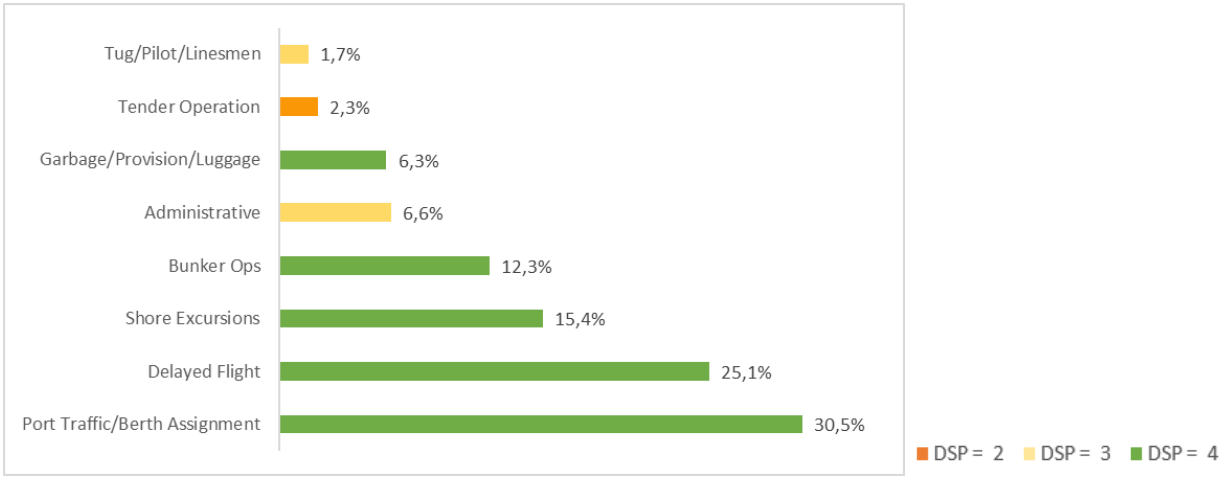


Figure 28 – Port Logistics/Operation Subcategories

Overall, unintended delays both at arrival and departure as well as short-term reroutings make for a major part of all the recorded incidents. Also, port traffic and involvement of shore excursions and passenger flights were shown to occur relatively often and would provide potential for the use of enhanced data sharing capability (Figure 28).

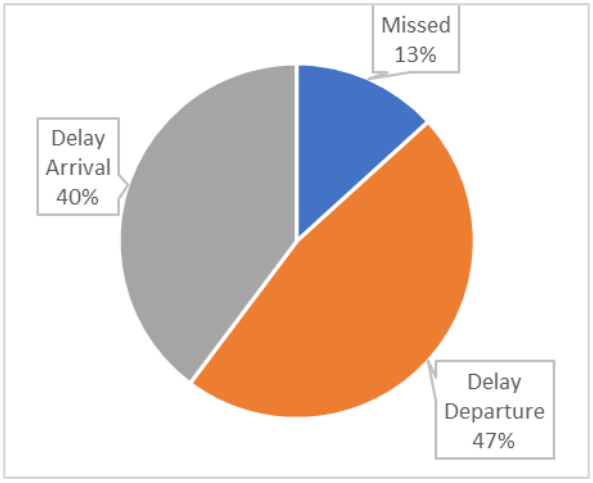


Figure 29 – Impact of Previous Delays

Furthermore, 5% of all incidents were directly caused by a previous delay (Figure 29). This included misses (13%), delays at arrival (40%), e.g. because the required speed was too high, and delays at departure (47%), e.g. because the laytime was extended to maintain the planned length of shore excursions.

4.2 Interviews

4.2.1 Overview

The interviews were analyzed using a mix of deductive and inductive approaches described in Section 3.4.4. The resulting coding structure is mirrored in the following subsections. Each subsection is supported with example quotes to illustrate the findings. The complete transcripts can be found in Appendix 7.8. An overview of the most pertinent findings is shown in Table 6.

Table 6 – Overview of Interview Results

Section	Interview Findings	Illustrative Quotes
4.2.2 Verification of Quantitative Analysis	- Quantitative Analysis matches interview findings, given the limitation of the data.	
4.2.3 General Observations	- Cruise ship port calls a heterogeneous environment and difficult to generalize - Agents & Pursers are crucial pieces in communication chain	*There are so many people involved in a cruise call, but only a few main connectors (PA1)*
4.2.4 Communication Methods	- Mostly Mail & Phone - Interviewees generally satisfied with quality of communication - Influencing factors: Agent, no. & experience of involved actors, time, type of information - Organizations with proprietary coordination systems more advanced & satisfied	*It mostly depends on the agencies (PO1)* *If we call them directly it works out quite well. On the weekends it can be a different story (PC1)*
4.2.5.1 Issues – General	- High punctuality - Low frequency of major issues - Most common issues: weather, technical defects, strikes, shore excursions, passenger flights - Differing views of onboard crew & (Scandinavian) ports/agent	*Cruise calls are so pre planned in detail from the beginning, and it is very seldom that the plan will change (PP3)*
4.2.5.2 Issues - Impact	- Main Impact: Passenger Satisfaction & Financial losses - Additional focus of ports: Promotion of city as tourist destination - Slightly opposing views on environmental impact	*(Delays have) an impact on the shore excursions booked, with the financial and guest satisfaction impact (PC1)*
4.2.5.3 Issues – Avoiding Problems	- Little Potential to avoid issues, as coordination works well - If major problems occur, it's due to reasons out of involved actors' control	*if the weather conditions do not allow the port then it is like it is and then there is no communication which can avoid this. (PC1)*
4.2.6.1 Sharing Timestamps – General	- 50% of interviewees saw PCMF as sufficient information type for their operation - Others wanted more information or already had sufficient systems in place	*That's the information we need on a cruise ship (PO1)*
4.2.6.2 Sharing Timestamps – Key Personnel	- High information load on agents & pursers - High improvement potential - all involved actors required to use same format to enable improvement - necessity for agents to adopt business offering	*I see potential in better and fast communication, that makes the communication onboard easier, and with the people ashore. (…) You can*

		reduce the costs with the port agencies. The question is if you need a port agency then. (PO1)
4.2.6.3 Sharing Timestamps – Third Parties	- lack of situational awareness of third-party operation, e.g. shore excursions - High potential in improving communication - Potential to reduce delays & improve efficiency	*(An improvement would be a) platform where all actors and not only two actors come together. Especially the communication with third parties could be enhanced. (PC1)*
4.2.6.4 Sharing Timestamps – Benchmarking	- Benchmarking already done to different extents by most interviewees - Potential to improve future operation & passenger experience - Potential for large-scale application - Potential for integration with other data sources & analysis	*And then the next port that opens up has the benefit of being benchmarked, and the ones who hide will probably lose the customer trust (PP2)*
4.2.6.5 Sharing Timestamps – Critique	- Interviewees with proprietary coordination systems content with their systems - Some interviewees averse to additional systems & prefer integrated solutions	*I would say that we have a good system. I would have to think about what (PortCDM) gets us that we don't have today. But I actually can't say that we are lacking some information. (PP3)*
4.2.7.1 Further Potential Use of Data – Port & Ship Information	- Interviewees criticized differing reporting procedures - In favor of an integrated & standardized communication platform - Potential for strategic use: berth booking, itinerary optimization - Potential for operational use: clearance, schedule deviations	*Each port needs to have all information, like guest data and crew data in different forms. You have several systems where you have to upload the files, so of course it would be great if such a system could include sharing this type of data. (PO1)*
4.2.7.2 Further Potential Use of Data – Clearance	- Clearance process to include sensitive data and high impact in case of mistakes - high potential for standardization and enhanced integration	*I think (enhanced data sharing) has a high potential, e.g. for immigration matters (PO1)*
4.2.7.3 Further Potential Use of Data – Tourism	- Some in favor of enhancing monitoring tourist-related activities & integration of other actors (local businesses, airlines) - include sharing of location of busses/passengers - enable a holistic tourism concept including all actors	*If we could have (shore excursion information) in a database (…) it would be good (PP1)* *Then (all stakeholders) can use their knowledge to get even better operations (PP2)*
4.2.7.4 Further Potential Use of Data – Port Traffic	- potential in sharing navigational & maneuvering information	*You could (…) include the ship's size, looking at the common size of ships coming to the port frequently and the maximum size of ships which call the port (PO2)*

4.2.2 Verification of Quantitative Analysis

One purpose of the interviews was to verify the findings of the quantitative analysis in Section 4.1, specifically the frequency, reasons, impact and data sharing potential of issues in cruise ship port call. Overall, the statements of the interviewees matched the findings of the quantitative analysis, given the limitations of the data which did neither consider geographical differences nor ships being too early. The data sharing potential for the three example scenarios was generally acknowledged. In addition, interviewees offered a spectrum of additional information regarding challenges in a port call and how to potentially approach them by utilizing data. Minor differences were observed. When asked about the frequency of issues, interviewees gave different estimates. Ports and agents were content with their performance, while onboard personnel described a high rate of inefficiencies. Furthermore, it was not possible to quantify the economic impact of delays, cancellations or reroutings, as this was stated to depend on many different factors.

4.2.3 General Observations from the Interviews

Overall, the statements of the interviewees agreed the findings reported Section 2.2. Many interviewees stated that the business environment of cruise companies and ports was rather heterogenous and the type of port operation often differed, depending on many factors. This includes geographical characteristics of ports, cultural differences, different technical or legal requirements, varying governance and business models or experience of involved actors. Furthermore, many stated that due to the number of involved actors and operations, it was difficult to have a complete understanding of the situation.

In that context, some interviewees underlined the importance of having a single contact person in each organization to facilitate communications.

> *Lots of information comes to me, but I just forward it to the responsible guys. But I understand it from a shipping company perspective - it is always nice to have one local person, and he can distribute the information. (PP1)*

> *There are so many people involved in a cruise call, but only a few main connectors (PA1)*

> *(in case of short-term reroutings) there's always something coming up what you haven't thought about what can be impacted by an issue. (…) It's important that everybody comes together, because in the office, nobody has a complete overview of what everybody exactly does (PC1)*

When speaking about the communication structure during the port call, two key persons were often mentioned - the shipping agent and the responsible contact person onboard, usually the purser. They both interacted with a large variety of actors and were named often the first contact person in case of schedule deviations or issues. Thus, they become important parts in the decision-making process since decisions can depend on information delivered by them.

> *I (as Purser) was the main contact person in the ports between the ship and all involved port parties. I don't have much communication with the port itself, but rather always via the agent who was talking to all involved parties (PO1)*

> *The main service is clearance, being a ship agent and clearing the ship. Otherwise the services we give are connected to the call, logistics, assisting with crew change, coordinating with deliveries and shipping, medical appointments. Anything you can think of (PA1)*

This supports the statement of PO2, a cruise ship captain, who saw his main focus on a punctual arrival/departure and relied on his onboard personnel to handle the operational port matters.

> *For the coordination of port calls I have various employees and I supervise mainly that we come in and out of the port on time, that the agencies give us the correct information, so I can use the traffic information to plan accordingly (PO1)*

PO1 mentioned that, except for security aspects done in cooperation with the port, all port matters go via the agent. PC1 described the three-way communication between shipping company office, purser and agent as an important part in the coordination of port calls and possible schedule deviations. In the case of the latter, both the company office and the purser happened to take the lead in coordinating the rescheduling process.

> *If something unplanned is happening (…) we will be involved and arrange everything with the agent shoreside, so the ship does not have to be involved with it. (…) (In some) cases the ships deal with the agents themselves via the first Purser (and) decide to arrange the berth themselves (PC1)*

The port security aspect from a shipping company's point of view was found to be one aspect part of the port call operation which requires a high degree of preparation and strategic planning. This included gathering information from various sources like specialized security providers or data bases. The port actors themselves were only considered as secondary sources of information due to the potential of local bias.

> *For us it is important to get an unbiased picture from a third party (…) Ports and tour agencies provide feedback, yes, but the main information we receive through what's called intelligence vendors. (PC2)*

4.2.4 Communication Methods

When asked about their means of communication in a port call, all interviewees named mail and phone. Overall, interviewees were content with these tools, although some mentioned that both systems have certain flaws, with mails not being checked all the time and phone calls not reaching all involved actors at once.

> *Emails in 99% of the cases, unless it's urgent. Then the ship is calling us from their phones, either mobile phones that they have subscriptions on onboard, or satellite phones which is normally very expensive for them, (PA1)*

> *Either you have direct communication with the telephone (…) straight away but only between two parties. Or you have all parties involved with an email, but you have to wait for a reply. Just a mixture of both would be perfect but that is not possible (PC1)*

Regarding the quality of communication, there were differing views. Most Interviewees in the ports were generally content with their quality of communication. Interviewees from cruise companies were more critical, with PC1, PO1 and PO2 naming the agent as important factor on the quality of the communication flow between ship and port. PC1 and PO1 said that the quality and reachability can depend on the agent, the port and the weekday, with the reachability being worse on weekends or outside of typical business hours. PP1 stated that the local agent's head office was located in another, bigger port and calls in that port were sometimes prioritized. The influence of the agent on port call efficiency was confirmed by PR2 who had done an analysis of port calls and found measurable differences depending on the used agency.

> *We produced some punctuality analytics for different calls, factoring in port of origin because we thought that might be influential as well. We also did an analysis of shipping agents, which showed some very interesting results.* It showed (…) the greatest variability of all. So, it seems like the shipping agent plays an important factor in all of this (PR2*)*

If we call them directly it works out quite well. On the weekends it can be a different story. The agents are usually not checking their emails on the regular base, so we tried to give them a call. I had also cases where I tried to get them on the phone for several hours. (PC1)

It mostly depends on the agencies. Some of them (…) are sitting in front of their computers or smartphones all the time and you get the answers very fast and efficient. But of course, you have some agents and agencies where you don't get any replies for hours or days. (…) I think it's the agency most of the time that are not doing a proper work. (PO1)

On the other side, PP3 stated that the agents operating in his port were working 24/7 and was satisfied with their performance. The agent PA1 was satisfied with the communication with ships but described the communication with other parties like authorities as occasionally poor.

Communication between us, the agent and the cruise line is very efficient and fast because we are used to the setup, and we send emails regularly. But when we work with authorities and vendors that are not so used to work with emails, they might have slow response times (PA1)

Two interviewees (PC1, PP3) stated that their organization implemented additional coordination systems. PC1 described a software which transmitted various real-time data of the company's ships, such as position and speed, and thus allowed advanced monitoring functions. PP3 described an app which was publicly available and displayed basic information regarding the ETA of scheduled cruise ships. Both PC1 and PP3 were very satisfied with the performance of these systems but acknowledged that other organizations might not have such tools. Another port interviewee, PP1, stated he would welcome having a similar system like PP3.

(In the app) you have some basic information for the commuter traffic and also a little bit about taxis, and the position of the vessel and the berth that they are on. (…) we will keep it as simple as possible (otherwise) it would be harder to handle. (…) It is integrated to our booking system. (…) If we change our arrival and departure times then it will send the new information to the app as well (PP3)

Furthermore, the experience and the relationship of the involved actors was often mentioned to be an important factor for good communication. Some interviewees attributed this to the different procedures onboard or in ports as well as to the fact that cruise ships often operate on repeating itineraries.

Let's say there is a new built ship going to the port for the first time, or an older ship is going to a port which they've never been to before. Then you can imagine it's a lot of planning and corrections (…) (In case of re-routings) we still have to think on our feet (…), but due to our experience in different ports, we know what the options are. (PA1)

Most of the ships have been here many times, so they know the drill, how it works. (…) Something we have learnt, that if they (declare waste disposal on) arrival, we will be there one hour later, because it never happens on arrival. Particularly if they arrive at 7 or 8 am, we know (…) that the guys are eating breakfast. (…) We save every note we have from the ships, all the berth plans (…) in our cloud. So, we have that to see how we planned something yesterday, and how we can learn from that to make it better. (PP1)

Challenges in the communication were often mentioned when talking about communication involving more than two parties on a short notice, such as rerouting (involving shipping company, ship, agent and port) or matters involving onboard departments (e.g. engine department, purser, agent). For such situations,

interviewees named using phone calls because it is faster than emails but acknowledged that it requires additional effort to keep everyone in the loop. PO1 also mentioned that due to the number of involved actors onboard, information may get lost easily. PA1 underlined the additional effort in case of data related to clearance, such as passport data, which has to be sent from ship to authorities via the agent and has a high accuracy requirement.

> *(Port calls are) quite difficult because you need to communicate with all the people onboard and also the agencies, so when something unexpected happens you need to communicate with everyone and be on two phones at the same time. (…) But (…) it's also difficult internally. Sometimes the information gets lost in the (onboard communication) chain (PO1)*

> *(Common problems) can be lack of communication, inter-departmentally onboard, or lack of communication between the head office and the ship. We are in many instances requested to send information to the head offices and also to the ship. (…) (The most common problems are) data errors (…) There could be wrong data about passport or visa numbers so that they get flagged by immigration. It could be the line of communication between the bridge and the first purser who is our contact person. For example, if they need a tug for departure but forget to order it or changing the departure time without telling us. (PA1)*

> *The major challenge is to get the information I communicate to the agent back to the ship, and vice versa. To get the response from the ship. Often, I feel like information gets stuck with the agent. (…) It would be much easier to communicate directly with the ship. (PP1)*

4.2.5 Issues in Cruise Calls

4.2.5.1 General

Generally, most interviewees were content with the pre-planning and the punctuality of cruise ship port calls, stating that the type of operation of cruise ships required such punctuality and that the long-term planning worked usually very well, especially compared to cargo ships. PR2 stated, after having talked with multiple stakeholders within a port about PortCDM potential, none has claimed cruise-specific issues. PR2 added that in an analysis over two years in one port, cruise ships were shown to be the most punctual of all ships.

> *Cruise calls are so pre planned in detail from the beginning, and it is very seldom that the plan will change (PP3)*

> *The cruise calls were always the most efficient, arriving just in time without any waiting times reported compared to the other types. (Efficiency of other ships) was significantly less. (PR2)*

However, there was a strong divide on the general perception of port call efficiency (see Table 7*)*, with interviewees working onboard (PO1, PO2) evaluating every third port call as non-optimal, and interviewees from ports or agents seeing almost no issues at all. However, several things should be noted here for context. The interviewees were usually asked *"Judging from your experience and giving just a rough estimate, how many port calls out of 100 do not go as planned"* or similar. Thus, the answers were based on estimation and personal experience rather than on collected data. Also, the definition of a "non-optimal port call" can differ and was not always clearly defined by the authors. In some cases, the interviewees interpreted

this as a port call with poor coordination, others as a port call with several hours of delay. Nevertheless, the difference was surprisingly strong. Possible reasons for this divide could be that there are multiple different onboard personnel involved in various internal communication channels, and that the ship is sailing in various parts of the world, while all ports interviewed for this thesis were located in Scandinavia. Since experience had been named as influence on communication efficiency, it may be that ports benefit from interacting repeatedly with multiple local actors and thus strengthening business relationships. However, these are only assumptions. An additional observation during the interviews was that some interviewees saw only issues specifically caused by another party as a problem, in contrast to non - influenceable issues like strong winds.

Table 7 – overview of estimates given regarding port call efficiency

Interviewee	Frequency of perceived non-optimal port calls
PA1 (Agent)	0,2 - 0,25%
PO1 (Purser)	30%
PO2 (Captain)	30%
PP1 (Port)	1-2%
PP2 (Port)	n/a
PP3 (Port)	<1%
PP4 (Port)	0%

Looking at major delays or port cancellations/re-routings, most interviewees stated that these were generally rare. If they occurred, it was often due to reasons out of the involved actors' range of control. Many mentioned strong winds or technical problems onboard as common reasons. PC1 also mentioned political reasons, naming strikes as one example. PP1 and PR2 also claimed that cruise ships usually had priority in the operational schedule, thus receiving services like pilots or linesmen first opposed to cargo ships.

> *It is only the weather that can change (…) or if you get any technical problems onboard the vessel itself. (PP3)*
>
> *(Delays) due to weather conditions (…) depend on the region. In the Canary Islands we had it very often. Then we also had to reschedule the ports (PO1)*
>
> *Rerouting, I have never experienced that. (…) Delays departure has never happened here, cruise ships are priority number one, so they always have the pilots in place. (PP1)*

When talking about inefficiencies due to poor coordination, shore excursions and passenger flights were most commonly mentioned, although to a lesser extent than the above. Some mentioned also that the impact of passenger-related events was smaller, since ships would just leave if it were a few passengers returning too late to the ship. PC1 stated that, opposed to information regarding delays due to weather, having more information about such delays would be beneficial for his operation. The operation and coordination of the actual port terminal was never mentioned as an issue.

> *Shore excursions arriving late, bunker barge being late (and delaying the) departure - this is information which could reach us earlier because normally it comes to us when it is already too late. Then it's also not clear where for example the buses are, can they really come back to the ship… So, this is all uncertain and of course also impacts the ETA for the next port. (…) If the third parties are involved in the communication - that would be very beneficial for us if we could have this type of information earlier. (PC1)*

Usually it was the unexpected things that made life difficult and challenging. Especially on embarkation day with delayed airplanes and passengers disembarking and embarking. It was the most challenging. (…) Flights had a lot of delays. You had it during the whole summertime, so that's a big impact. (PO1)

It's quite rare that we wait for more than 10 minutes for passengers being late, unless it's because of a traffic accident, and you have many passengers that have not made it back yet. Otherwise the ship would sail and the passengers who missed the ship will be sent by train, bus or flight to the next port. (PA1)

When (delays of shore excursions) happens, (the delay is) less than an hour. (PP4)

PO2 saw the main issue in poor coordination and named poor scheduling of port traffic as the major impact for low punctuality in arrivals and departures. PO2 named the port as responsible, claiming that ports would often not account for differences in ships' characteristics such as size, maneuvering capabilities or planned maneuvers inside the port area, which would result in unexpected, short-term schedule changes and delays, especially in popular cruise ports like Barcelona. PO2 also suggested that this issue would become more significant in the future as newbuilt cruise ships are becoming bigger and the physical port capabilities and characteristics will stay the same.

For example, ships all of a sudden have to turn while berthing, even though nobody was aware of this previously. Insufficient information available to all parties, which then affects the available time window. (…) This has to be coordinated in a better manner, especially from the port who knows this in advance. (PO2)

Most interviewees agreed that if deviations from the schedule occurred, delays of several hours, short-term port cancellations or re-routings required a significant amount of effort compared to other schedule changes. However, this was also subject to the specific nature of the event and the involved parties. Generally, more hours of delay and the involvement of more actors or actors outside of the immediate port operation were said to result in more effort needed. Interviewees also agreed that such incidents often required decision-making in a short time. From a cruise ship company perspective, PC1 stated that a re-routing required more effort for those ships which operated in a business model with partial passenger exchanges in every port. PO1 stated that ports with only shore excursions was relatively easy to reschedule, but it was difficult when more services, such as bunkering or provision loading, were involved. PP3 stated that re-routed ships were often assigned to a certain port nearby which reduced the effort substantially.

It depends on the extent - if it does a delay of only one hour it has only a small extent. (…) For some ships it is quite a big impact if we have to change (or) cancel ports completely because these ships have a partial turn around in every port. It impacts them a lot and also the flights (PC1)

Several port interviewees mentioned that cruise ships arriving too early happened more often than arriving too late, which from their perspective was seen mostly as a negative occurrence. This was not mentioned by anyone from the cruise ship crew or office. PP4 was very critical, claiming early vessels would pose a much bigger inconvenience to their operation than late vessels due to the need of rescheduling all involved actors on a short notice. PP2 claimed early arrivals would not be an issue as long as the port had a system to handle such calls appropriately, although the existing system was not entirely sufficient in that regard. On the other side, PP1 welcomed early arrivals, stating that such early arrivals usually occurred within the scheduled standby time of the port crew and thus allowed for more time and less stress for the initial port operation, such as rigging the gangway.

(early arrivals are a) big problem, because you obviously need linesmen to moor the ship. You also need security guards to cover the ISPS area, so it's a big issue. Rather late than early I would say. (…) I believe that from the ship side they take it for granted that they can arrive at 06:00 when they are scheduled 07:00, and that everyone should be prepared. That is seldom the case (PP4)

(Early arrivals) affect the processes and the costs because we have to be earlier on the quay side, the management and the linesmen and the port authority. So, we want to be sure we don't have an issue with the ship being too early (PP2)

The ships are often coming too early to the port. Of course, that is good from our point of view. (PP1)

Several interviewees mentioned how issues might arise due to specific characteristics of the involved actors. For the cruise companies, different business models, such as doing partial passenger exchanges in different ports, different onboard communication structures or differing constructional requirements like shell door placement were mentioned. For the ports, the factors geographical location, local regulation or internal structure were mentioned. PP1 stated that he ordered waste disposal services for every port call, independent from what the ship ordered, because the port was legally required to offer these services and ships often failed to ask for it in advance. PP3 explained that local regulation affected vessels differently depending on size, resulting in possible navigational restrictions. PP4 described weather situation, local requirements and port organizational structures of having an impact on the operation. PA1 stated that many ports in their business area were comparably easy to handle due to the lack of pilot requirement. PR1 named Rotterdam as example of a port with a more centralized internal structure which results in the harbor authority having more responsibility than in other ports.

One of the special conditions in Rotterdam is that they have a very strong harbor authority which is responsible for quite a few things which other harbors don't have, so it is a bit more centralized than you have it in other ports (PR1)

I believe it varies what kind of port you have. If you have a weather sensitive port, cancellation due to bad winds are more normal. (In one of our ports), last year we had 11 cancellations due to the wind out of 90 calls. (…) (In my previous port of employment) we had other issues, like the weather situation and the restrictions in the archipelago with wind restrictions which could affect time of arrival or departure. (…) There they are working a bit differently because the turnaround handling is provided by third party actors rather than by the port itself like it is here. (PP4)

4.2.5.2 Impact

Most interviewees agreed that disturbances in port calls would to lead to lowered customer satisfaction of the passengers which was seen crucial to most companies' business models and thus financial revenue. Shore excursions and passenger flights were seen as important factors in ensuring such customer satisfaction, with especially the latter bearing a high risk for negative financial impact. PC1 mentioned also that particularly popular ports had a higher impact on satisfaction than others due to being either popular or the hub for passenger exchange. Besides passenger-related operation, PO1 stated that cancellation of ports where extraordinary events like technical maintenance were scheduled posed an additional negative financial impact.

We have ports which are the major highlights on the cruise and if we cancel those because of weather or if we cut the port call short, then of course it impacts guest

satisfaction. (…) It has an impact on the shore excursions booked, with the financial and guest satisfaction impact (PC1)

The impact is of course the happiness of the quests, (…) our main objective. If you have any logistical issues with loading or excursions, if things are not running smooth it will impact the happiness of the quests (PO1)

(Delays impact) the guest satisfaction. That they have a bad experience and only sit in buses without being able to see the things they want (PP1)

From a security perspective, PC2 stressed that schedule deviations leading to time pressure had several negative impacts. Giving the example of a delay of multiple shore excursions, PC2 described that a high number of persons arriving at the port in a short time would potentially require the security personnel to lower their standards. Additionally, extending the scheduled work hours would lead to surcharges of port security and possible work time violations or fatigue of onboard security.

Proper screening of a person takes a certain time, and they might not have the time because the Captain is pushing, (…) circumstances are pushing, high tide or low tide, availability of pilots... Interfering with security standards is never, never a good thing. (…) Every delay is a problem in terms of cost, in terms of quality and in terms of potential violations. (PC2)

While interviewees from the shipping company were focused on a smooth operation within the port, port interviewees showed additional concern for stakeholders outside of the port. This was mostly in relation to promoting the city as a popular tourist destination or concerns regarding local inhabitants' quality of life. Both PP1 and PP2 mentioned a close cooperation with local authorities, especially regarding possible disturbances in the cities such as construction sites, to ensure a smooth operation for shore excursions and transportation. PP1 underlined his cooperation to the local tourist bureau and their aim to promote the city as attractive tourist destination. PP2 claimed that a close cooperation with the city was crucial for both social and environmental sustainability, naming Mallorca as a tourist destination where too many tourists have swayed locals' tolerance, and that increased cruise traffic required both an appropriate operational and strategic approach including all stakeholders.

While environmental sustainability has not been a primary focus of the interviews, it is interesting to note that only PP2 and PP4 mentioned unnecessary fuel consumption as issue arising from operational efficiency. In contrast, when talking with PC1 about delays of less than one hour, PC1 saw increase of fuel consumption from such delays as tolerable and underlined that cruise ship operation is subject to imprecisions.

(if ships arrive early) they might need to wait for half an hour to wait until the linesmen are in place, so they (…) burnt a lot of fuel unnecessary to arrive at the destination early only to lie there and wait for the linesmen (PP4)

Well half an hour delay how much is this going to affect the arrival speed? Not much. And I also tell other persons in my company: it is called ETA which stands for estimated time of arrival otherwise it would be TA - Time of Arrival. (PC1)

4.2.5.3 Avoiding issues

General consensus was that enhanced data sharing capability was not suitable to avoid major problems in the port operation. This was due to two reasons. First, cruise ships were seen as punctual and benefitted from the long-term planning of port calls. Many interviewees stated they saw high potential in such timestamps for cargo ship but not in cruise ship operation. Second, major issues like delays or port

cancellations were not only claimed to be rare but also to occur due to events which seldom could be avoided or influenced, such as strong winds or technical problems.

> *If the weather conditions do not allow the port then it is like it is, and then there is no communication which can avoid this. (PC1)*

One of the cruise managers, PP1 specified that cruise ships receive prioritization over cargo ships as an unwritten rule. In events where resources such as pilots, linemen and tug availability are strained, the cruise ships always get the first service, thus allocating potential delays to other cargo segments within the port.

> *Delayed departures have never happened here, cruise ships are priority number one, so the always have the pilots in place. This is not a written rule or regulation, but simply what we do. We know that the cruise companies don't want to be delayed (PP1)*

4.2.6 Sharing Timestamps

4.2.6.1 General

Interviewees were generally positive about the idea of sharing timestamps in a standardized way. Common themes were improved transparency, improved communication flow between more than two parties, inclusion of actors outside of the immediate port environment and thus reducing the workload on key personnel in the communication processes, such as agents and pursers. Six interviewees were asked in which situations of their operation the time stamp information contained in the Port Call Message Format (PCMF) would not be sufficient and three (PP3, PP4, PO1) agreed there were none or very few. Others stated they already had sufficient systems in place or required additional information, the latter being described in chapter 4.2.7.

> *That's the information we need on a cruise ship. Bunkering at what time, provision on what time, if something is delayed (…) until what time it's postponed. (PO1)*

> *There are several actors involved in a call. (…) I think it is a good idea, to have it via one channel so to say. Very beneficial. (PP4)*

4.2.6.2 Supporting Key Personnel in the Communication Chain

The communication with the agent was mentioned by various interviewees, such as PC1, PO1 and PP2, as a point for improvement. PO1 and PP2 expected utilization of PortCDM as a way to enhance the communication quality with the agent and to reduce the costs. PP2 and PR1 went even further and claimed that, if agents did not adopt such capabilities created by new technologies, they would suffer competitive disadvantages. PR1 elaborated that the function of an agent was historically based on a maritime business model which had a very low level of connectivity, and that new technologies would reduce the necessity of an agent.

> *The communication with the agent could be more efficient. (…) The communication with the shore Based Services like shore excursions are linesman could be enhanced because right now this is all done by the agent. (PC1)*

> *PortCDM and data exchange will not eliminate the agents for example, but it will change how agents will behave. (…) They can (…) provide better services to their clients. If they don't do that, clients will go somewhere else or simply do it themselves (PR1)*

> *The agent will probably have less work (…). If they are going to be protective (…) ships are going directly to the port and ask what services can you provide directly through*

PortCDM? (…) It can go really quick in a bad direction for the agent if they don't open up and provide services in a PortCDM environment (PP2)

Agents are doing port coordination due to the fact that you didn't have connectivity. (…) That is all changing when you start to exchange information, and PortCDM is an important aspect in that (PR1)

From an agent's perspective, the two interviewees PA1a and PA1b were generally content with both communication and performance of their services. PA1a and PA1b had mixed views on the potential of sharing timestamps - PA1a claimed much better reachability and communication via phone. He added that communicating via a single platform would make things more complicated because the agent interacted with a high number of actors which were often outside of the port, such as crewing agencies in Indonesia or local authorities. On the other side, PA1b was more open to the idea of utilizing timestamps, showing sympathy for using an app due to the possibility of sharing notifications and timestamps and thus increasing efficiency.

(ETAs are) set two years in advance. Things that happen on short notice are communicated over phones anyways, because you have people who are not online at all time. (…) We email and receive communication from a crewing agent in Indonesia to port agents in other ports, national authorities, coast guard, navy, different departments onboard the ship, head office, technical officers of the cruise line, delivery companies... I actually think having a system would make it more complicated (PA1a)

I do like the idea of having an app sharing the information. We would have to come up with notifications and people would have to get used to it (PA1b)

On the other side, the purser PO1 saw a high potential in sharing timestamps, naming it a very useful support tool to make communication faster and more efficient. However, this would require all involved parties to use such method to make it effective.

I see potential in better and fast communication, that makes the communication onboard easier, and with the people ashore. I think you can reduce the costs with the port agencies. The question is if you need a port agency then or for which services. (…) Everyone would then need to utilize this possibility and share their data, (…) (keep) their data updated, (be) online all the time - then I think it's quite easy to work with and easy to avoid any communication mistakes (PO1)

Other involved actors with a smaller number of communication partners might also benefit from receiving real-time information in a standardized format. A challenge would be the categorizing and filtering relevant information. PC2 stated that receiving too much unnecessary information from other port actors might be a challenge but that having too much information would be preferable than too little.

(Security Officers) can delete a message if it doesn't affect them, rather than not being informed at all. (…) Standardized formats which are kept short would be preferred. (PC2)

4.2.6.3 Enhancing Communication with Third Parties

PC1 and PO1 also saw potential in improving the communication with third parties, such as shore excursion agencies or airlines. PO1 added that sharing timestamps had high potential for the communication onboard as well, distributing information easily and fast to all relevant parties inside the ship's organization. PO1 saw this as a way to enable improved decision-making. Regarding third parties, PP1 experienced a lack of awareness of activities and responsibilities of other actors. PP1 attributed this to the differing structures in ports and onboard which promoted doing all communication via single contact persons like the agent and saw PortCDM as way to enhance such situational awareness. PP4 saw potential in including service

suppliers like garbage or bunker services in the communication chain and agreed that the timestamp format included in PortCDM would be sufficient for this.

> *(An improvement would be a)* ***platform where all actors and not only two actors come together. Especially the communication with third parties could be enhanced. (PC1)***

> *When it comes to garbage and supplies of bunkers (etc.), I believe it is very useful to know when the service has arrived at the ship, and when they are finished with the service. I believe it is very good to know when the shore excursions are coming back. (PP4)*

PP2 described how sharing of timestamps could improve situational awareness of actors who are not directly included in the port call, thus allowing them to use such information to their advantage. An example would be taxi drivers or restaurants who could predict high numbers of passengers in their area. Furthermore, PP2 described integration of the maritime sector with other sectors inside the city, such as the public transportation or the medical sector. He named connecting PortCDM with the so-called "Smart City" concept as example.

> *With open data you can also contribute to the municipality in a better way. So, it's not only the cargo owner's perspective but other service providers gaining from this. Not only the cargo but also restaurants (…) in the case of a cruise industry. Even (…) taxis should have an interest in knowing how many passengers are coming, maybe they could go to the city center or to the airport. Then they can collaborate with colleagues (for example) and ensure that there are enough taxis at the airport or the quayside. (…) I think in the future there will be a lot of integration between PortCDM and smart city CDM. I talked with (researcher in PortCDM) and he said we can use the same concept for Smart City CDM aspects. (...) Here I see benefits for the municipality and the city. (PP2)*

Vice-versa, it would be also beneficial for actors onboard the ship to receive more real-time information from parties outside the port. PC2 described various events during a port call which could result in affecting the security and for which it was important to receive continuous updates about any changes. Examples included elections or religious holidays with possible risks being public demonstrations. He stated that for such cases, he used various different information sources, including mail communication with other major cruise companies and push notifications by specific security agencies, but that there would not be a continuous live monitoring. In case of an emergency, timestamps could also be used to keep an overview of the shore parties, e.g. by shore excursions sending a single notification that they reached their contingency location.

> *(During) elections in Spain, it was of the utmost importance for me to know what was going on in the cities at every moment. When the poll stations open, when the first results are in, (etc.) (…) Other than notifications sent by these (information agencies) about a specific event, there's not really any live monitoring. (…) We do maintain corporation with cruise lines (…) outside the corporation for this very reason. It is always in real time, but it is again this classic email ping-pong. (…) we take this information as a puzzle piece, (if) it's either true or not, but it's better than having nothing. (PC2)*

4.2.6.4 Benchmarking & Data Analytics

Almost all interviewees stated that they already collect and record certain operational data and use it to monitor performances and possibly adapt their operation. There were however differences on the why, how and to what extent this was done.

Most interviewees did this out of company policy or "best practice" with the aim to improve their own operation for the future. PO1 recorded any incidents in port calls, claiming this was a personal policy. All port interviewees stated that they recorded various information from the port calls. PP1 and PP4 added that they worked together with local tourist agencies to include passenger satisfaction relating to shore excursions in their performance evaluation. PC1 was in his function recording delays of more than one hour according to company policy, claiming he was not aware on how and whether that data was used. To do this, the company used both manual reports from onboard personnel and a monitoring software which automatically gave alarms in such cases based on positional data, although PC1 rated the software effectiveness at only 50%.

There were generally favorable views on the potential value of recording timestamps for benchmarking. Some, such as PC1 and PP3, were content with their existing methods and did not see a high necessity to improve upon it. Most however saw more data sharing capability as a way to gather data more efficiently and to use it to improve their business model. PP1 and PP2 saw high potential in monitoring shore activities, such as excursions, to improve passenger experience. PP2 and PP4 saw high potential in creating KPIs. PP4 saw it as useful tool to monitor performance of service providers.

> *If by the end of the season you can speak to (…) the Shorex that 'this summer you had 120 buses that were later than scheduled', or you could say the 'we ordered waste at these times, but you arrived late 25 times last few months' - It could be very useful to evaluate the seasons afterwards. (PP4)*

Some saw the value on a larger scale than the immediate operation of port calls. PP2 saw KPIs as method to benchmark and compare different ports in a region which would prove beneficial for the entire maritime sector. PP2 added that early adopters of such KPIs would have various advantages as it allowed them to utilize Quality Management tools like Total Quality Management or Lean to improve their operation and thus to improve their operation faster than competitors, in addition to attract more customers due to higher transparency of their business model.

> *And then the next port that opens up has the benefit of being benchmarked, and the ones who hide will probably lose the customer trust in the long term (PP2)*

Some saw potential in combining timestamps with other data sources. PR2 described the STEAM (Sea Traffic Management in the Eastern Mediterranean) as an example which aims to create a "smart port" by combining timestamps, AIS and environmental data in a single platform. This could potentially help to detect patterns and relationships between such data to enable further analysis and new business solutions, such as improved berth planning. PC2 stated that utilizing historical data would make sense from a security perspective, e.g. to know where hotspots are in terms of protests or theft. In that context, maritime data could be connected with data from security platforms which were often not aimed at the maritime sector.

> *There is a lot of value in having information that refers to specific events. Let's say, in Spain, we know that port workers frequently call for strikes. So now our experience shows that cruise operators are usually not affected. So, it would be good to know the impact of certain industrial actions, so we know potential outcomes. (PC2)*

4.2.6.5 Critique

Those interviewees who stated they used more advanced communication systems, such as PC1 or PP3 with their proprietary monitoring software or traffic app respectively, claimed they were content with their system and would likely benefit less of adopting another technology than other organizations. When talking about the app used by PP3, PP1 stated he was favorable of the idea of utilizing an app which included PortCDM functionality.

I would say that we have a good system. I would have to think about what (PortCDM) gets us that we don't have today. But I actually can't say that we are lacking some information. (PP3)

I mean this information we have available anyway. (…) We are in a situation that we already have a lot of information with the software we have (…) (In case of small delays) we get a notification via our system anyways. (…). If the ship is late by let's say 40 minutes, it does not impact our operation at all (PC1)

On the other hand, there might be improvement potential for such advanced systems in terms of integration capability and standardization. PP2 saw a common system as a way to make connectivity more efficient and cheaper, naming an average cost of approximately €8000 for every integration with another M2M system. PP2 saw PortCDM as opportunity to invest this sum only once whereas a proprietary system would require several integrations in addition to maintenance and updates. PR1 explained the high efficiency of cruise ship companies arising from their business environment and added that, even despite well-developed systems, even market leading companies required outside connectivity as well as they always operated in a connected environment.

After 10 years (...) we have a rough estimate that for each partner in the integration it's going to cost approximately €8000 (...) to integrate. (…) Later you have the costs if actors want to change something to their API or EDI-message, which is not standardized of course. So, integrating is difficult if you don't have standards. If you have a PortCDM environment (...) it will cost the port €8000, it would cost the ship €8000, and the integrating to the thing in the middle would always have approximately be the same cost. I would not have pay €8000 to integrate with every single actor individually. So, there is a lot of money you can save integrating into a common system (PP2)

A large part of what we call PortCDM, it's done by (cruise ship companies) anyhow. (…) The pressure on them to do that was always very high (…) so they started inventing ship operation centers. It's because they needed that communication and that connectivity, and as a result they are much more precise. (…) (However, their) internal systems are built up and geared up for (their) organization and own internal environment, even Carnival cruises or MSC cruises are not an island, (…) not isolated. (…) Most of the ports are mixed, so you have cruise terminals, but you also have cargo terminals, you have other vessels going back and forth, work boats and so on (…). When you are connecting yourself with PortCDM, the PortCDM ports can provide you with much more accurate estimated, requested or suggested times of arrival (PR1)

Some interviewees were hesitant about new data sharing concepts if it would involve creating a new platform and stated that for a new technology to be successful, it would require proper integration into existing systems.

If you add on more systems, the risk is big that they miss something. At the end of the day you should have one system, be it the PortCDM or the (Maritime) Single Window, but you should have one system covered it all. (PP4)

When asked about the potential of exchanging timestamps for port-port communication the general consensus was that this might provide benefit for cargo ships but would have very limited use for their operation in the cruise ship environment. Only PP4 deemed it explicitly useful, stating it would facilitate calculation of a fee which depended on ships' previous waste discharges.

To my knowledge (port-port communication in case of reroutings) is not done and not important. If we have to reschedule, we just get in touch with the new port and the agent (PC1)

When it comes to this "no special fee" regulation, it could be very good to know how much waste the ship discharged in the port before you. When it comes to that aspect, I think the (port-port information) sharing could be good. (PP4)

4.2.7 Further Potential Use of Data

When talking about potential of enhanced data sharing in cruise port calls, several interviewees mentioned different applications which are currently not in the scope of the PortCDM concept.

4.2.7.1 Port & Ship Information Platform

Overall, interviewees were satisfied with the berth planning process, claiming that the long-term process made planning easier than berth planning for cargo ships and thus enabled more flexibility. However, several interviewees saw potential in improving the access to ship and port information, e.g. through a shared transnational platform showing information like cruise ship schedules, administrative port requirements and berth bookings.

For the pre-planning phase of cruise ship itineraries, this would potentially bring more transparency, facilitate communication and help to optimize berth usage and itineraries. PP1 described the current situation in his port, where most shipping companies booked berths via their local agent, and sometimes ended up being scheduled in a container port because other berths were already occupied. PP1 also described a platform called "Cruise Calendar" where various ports and berth capacities in the Scandinavian region would be visible for shipping companies, although claiming an even more widespread solution would be useful as well.

Furthermore, PC1 and PO1 saw potential to improve operational processes with a standardized platform – PC1 imagined a system to easily check availability of berths and services, as well as related costs, to support decision-making in case of short-term reroutings. PO1 stated that such a platform would be highly beneficial, especially if port-specific information and documents were available and if it was possible to upload such documents in a standardized way, underlining the high effort required to send a large amount of data, often with slightly different requirements, to every single port. PP1 criticized cruise companies' current procedure which involved frequently requesting the same information to stay updated. Furthermore, he criticized it was difficult to obtain information from the companies in return, e.g. ship's plans.

Each port needs to have all information, like guest data and crew data in different forms. You have several systems where you have to upload the files, so of course it would be great if such a system could include sharing this type of data. (PO1)

The easiest way I can imagine is one platform where everybody has access to and (agents, ports, service providers, etc.) can confirm their availability with some details and (…) a checklist and then you could see (which operations were planned, and which are possible). (…) Then I could confirm the port and I could see the financial cost for the port, the individual cost for the suppliers. Then we can make a decision if we go or not (PC1)

Due to the multitude of involved actors in a port call, it might be difficult to find a one-fits-all information standard. Certain information might only be relevant for certain actors or in a very specific context. A

common platform would have to include certain functions to filter information in order to be helpful. As example, PC2 named the sunrise/sunset times in a security context.

> *What does it mean, sunset at 19:00 or (…) 21:00 in terms of risk? A port planner most likely has zero information content wise, while a security person would understand. It's good to have the information, but the right people will need to read it and work with it. (…) (In) certain databases there is too much information that is useless. There must be standards what is required (…) and makes sense - to limit the volume and make it more useful. Other than that, it never hurts to have data. (PC2)*

4.2.7.2 Clearance Process

Some interviewees, such as PP3 and PA1, saw opportunities to enhance the clearance process, a process which is both important and involves sensitive data, by linking administrative onboard systems directly with national reporting platforms. Several stated that this would save time and prevent issues, such as passengers not being allowed to go ashore because of immigration issues. PA1 underlined the sensitivity of the involved data which would require good security standards and high accuracy. PO1 described examples where small mistakes, specifically inaccurate passport data, resulted in a long delay. PP3 and PA1 stated that they would like to advance integration into existing reporting platforms, such as the Maritime Single Window. PA1 added that integration of existing systems would be far more preferable to creating new systems.

> *I think (enhanced data sharing) has a high potential, e.g. for immigration matters. One morning we had an immigration officer coming onboard and said that two of the passengers had to come to the clearance, otherwise the ship will not be cleared. If we knew something like that already on the previous evening we could have informed the passengers and everything would go much faster (…) Knowing in advance that customs are not as fast we could schedule loading for a later time during the day when we knew (authorities) would be finished with the clearance (PO1).*

4.2.7.3 Tourism

Several port interviewees were interested to enhance the information about tourist-related activities, such as sharing planned routes and real-time tracking of shore excursions. This would allow them to improve the overall service offering to both cruise companies and passengers. PP1 saw potential in ports giving tourist-related expertise to ships, stating he already researched companies' shore excursions via their websites and took the initiative to propose improvements to the companies. This, he claimed, was however his own doing and could be more efficient if done as a standardized process.

> *If we could have (shore excursion information) in a database, so everybody knows where the buses are going, and they are dropping passengers off, it would be good - also from a marketing perspective when we visit the cruise line. Then we can have this information that' you are normally doing these tours, maybe you could think about these (instead)?' (…) You can also use it (for) statistics and analyses. Because now we are doing it for ourselves, going into their webpages and look at what they are doing, then compare with other cruise lines. (PP1)*

PP2 promoted more collaboration and information sharing in general and between all parties inside and outside of the port. He named JIT operation as desirable goal for all operations in the value chain, including all operation outside of the port area, such as public transportation. However, to achieve this goal, it would be necessary to collect and share relevant data.

> *For the cruise ship calls, it's of course the passengers which are the cargo that the cruise ships deliver to the communities (…) You have public transportation, how can you interact with them in a good way, regarding environmental or safety issues? So I think to get just-in-time (operation) to work in the value chain we need to look not only what happens on the quay side (…) So, then (all stakeholders) can use their knowledge to get even better operations or they can choose other and more efficient routes. (PP2)*

PR1 spoke about the possibility of enabling new actors outside of the maritime field utilizing ship-related data, giving the example of a fashion brand relying on fast logistics cycles using shipping data for their operation. A similar effect would be possible in the cruise ship sector with tourism-related data.

> *(The fashion company's interest) is in transparency so that they can organize their fashion weeks as early as possible. That is something I never envisioned, that (this company) is interested in PortCDM. Because they don't have ships, they don't have ports, they are not a shipper. They give it to DHL or someone else to handle it, but they want that transparency. That is what is necessary in today's world. (PR1)*

4.2.7.4 Port Traffic Information

PO2 saw potential in sharing navigational information of other ships to improve the port traffic coordination. This would apply for both cargo and passenger ships. Such information could include ships' size, maneuvering capability and estimated durations and execution of maneuvers within the port basin, which would help navigators in planning their own maneuvers in a timely and safe manner.

> *You could (…) include the ship's size, looking at the common size of ships coming to the port frequently and the maximum size of ships which call the port. Because according to this, you also become more cautious when maneuvering, no matter if you're on a cargo or passenger ship. (PO2)*

5 Discussion

This section contains the discussion of the empirical findings in relation to the theoretical framework to answer the two research objectives. First, limitations of the data are discussed. General findings on the cruise environment are presented to answer the first research objective on factors influencing operational efficiency in cruise shipping. Operational, strategic potential and challenges of enhanced data sharing concepts are discussed to answer the second research objective on the potential of an enhanced data sharing concept for the cruise industry.

5.1 Limitations of the Data

5.1.1 Quantitative Analysis

The data set showed various interesting findings. However, it only showed the perspective of one of the involved actors in a cruise call, the cruise company. It would be interesting to connect the incidents described in the data set and connect them with data from other parties, e.g. overtime hours of port workers or delay of other ships.

Limitations of the data set led to various assumptions which were described in the previous chapters. These assumptions were based on the context in which the data were collected and in case of ambiguities, a more cautious assumption was chosen. The process to assign a DSP factor to every incident turned out to be extensive and might have been more streamlined in hindsight.

5.1.2 Qualitative Analysis

The selection of the interview participants was primarily focused on persons and organizations in Northern Europe. While this was not the focus of the thesis and is the result of unsuccessful recruitment efforts to persons outside of these regions, it nevertheless skews the results, since geographical and cultural influences were mentioned several times as impacts on cruise ship operation. Thus, results might have differed if interviewees from other regions would have been involved.

The cruise companies and ports which were interviewed were not analyzed by their characteristics like size, number of annual port calls or cultural differences. Comparing findings specifically from two similar or very different organizations, e.g. two highly popular tourist ports or a major and a minor cruise line, might bring interesting and differing results.

The semi-structured interviews helped to create a friendly setting and give the interviewees freedom in answering. This resulted in answers covering a wide variety of different subjects. In hindsight, more precise questions could have narrowed down the topic variation and facilitated the analysis.

5.2 General Findings on the Cruise Environment

5.2.1 High Efficiency

Overall, cruise ships were shown to be more accurate and efficient in their operation than cargo ships. This was shown by comparing the quantitative findings in Section 4.1 (schedule deviations in 6% of port calls, average delay 3,7h) with previous research on the operational efficiency of cargo ships (Section 1.1). The difference in efficiency was also highlighted by multiple interviewees. This is due to the elaborate planning process, the business model which relies on tight integration of passenger-related operations and comparatively advanced coordination systems used by the industry actors. Any schedule deviation has the potential to negatively impact passenger satisfaction and thus financial revenue.

The existing structures and processes are capable to handle most minor unplanned events. This was confirmed by most interviewees and the quantitative data analysis where incidents due to port logistics/operation were shown to have a comparatively low impact. This was shown by the low average hours of delay in those cases (average delays at arrival/departure 2,2h & 2,4h compared to 3,7h in total, see Figure 21)

and the interviews where several interviewees were content with the port operation (Section 4.2.5.1). Main challenges are from uncontrollable disturbances, like adverse weather or technical malfunctions, and disturbances of passenger-related third-party services, i.e. shore excursions and passenger flights. Schedule deviations at departures showed higher uncertainty which matches previous findings about operational efficiency in cargo shipping.

5.2.2 Heterogeneity

The results from the interviews show that the environment of a cruise ship port call is even more diverse and heterogeneous than found in the literature review. While it was a challenge in building the theoretical framework, it also presents an opportunity for this thesis to contribute to the common body of knowledge by providing reliable findings on this topic. A high number of actors are involved during a port call, often operating simultaneously and in episodic couplings of different lengths. The requirements and capabilities of these actors often differ. In addition to those actors within the port, the port call affects and is affected by external parties as well, including local actors or private and public transportation. As a result, a ship changing its operational area from e.g. Scandinavia to the Mediterranean or a port receiving a ship for the first time will result in additional administrative work. This heterogeneity is further reinforced by a lack of standardization. Although many actors have standardized internal processes, it is difficult to synchronize these processes with other actors. An example would be different clearance processes in different countries. Previous efforts for more standardization through streamlined trans-national MSW processes have failed, partially due to a lack of governance and direction by policy makers (Section 2.3.4).

To illustrate these findings, the cruise value chain depicted Section 2.2.3 has been expanded by adding policy makers and external parties as additional actors (Figure 30).

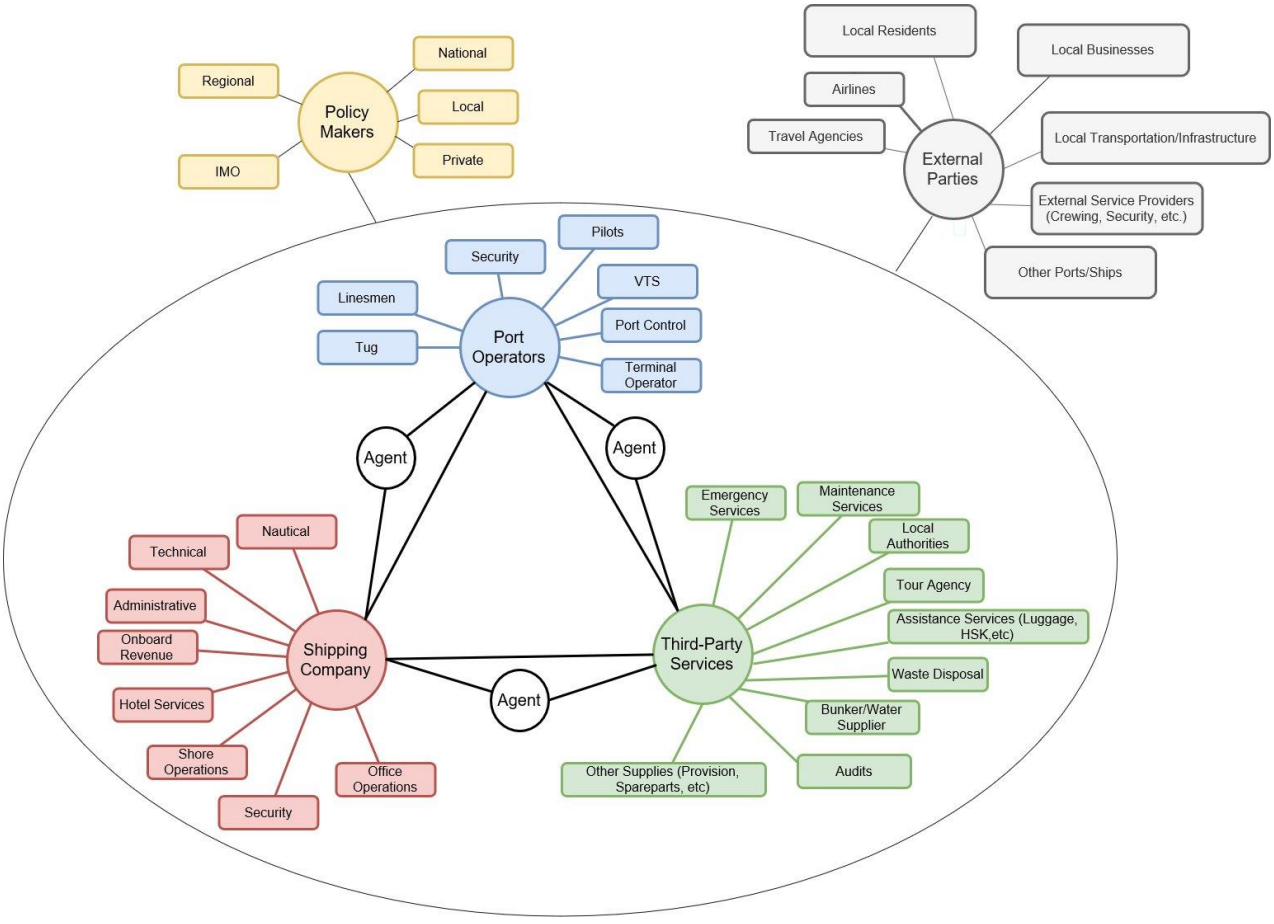


Figure 30 – Extended Trinity in Cruise Value Chain

5.2.3 Importance of Communication

In this environment, the ability to exchange information fast and efficiently is a crucial factor for day-to-day operations and overall value creation. This results in a high dependency on personal communication and coordination. This confirms the literature findings in Section 2.1. The quality of coordination is strongly influenced by the experience of the involved actors, technical support systems and key communication personnel like the agent or purser who aid the coordination between the other actors. Especially complex situations, which either involve multiple actors or which require short-term decision-making, can benefit from fast and efficient coordination.

The coordination before and during a cruise call is mostly done via mail or phone. At a certain point, organizations implement advanced coordination systems which are tailored towards their needs and operation. Examples are a port app showing cruise ship movements or a software for a cruise company for monitoring their ships. These systems are usually not designed to integrate outside of the designed scope and every additional integration would cost time and money. For smaller organizations, adopting such systems would pose a financial challenge. Several interviewees also preferred integration of new functions into existing systems instead of implementing new systems which supports the need technology standardization. This was especially evident regarding the clearance process, covered in chapter 4.2.7.2.

5.2.4 Potential Indirect Impact

Besides the direct impact of schedule deviations on customer satisfaction and financial revenue, there were also hints of various indirect impacts on other actors in the value chain (Section 4.2.5.2). Since cruise ships often receive priority service in ports, a delay in their operation might affect other cargo ships in the port awaiting service (Section 4.2.5.3). Other impacts arising from delays may only become noticeable at a later time. This includes the quality of security when onboard security personnel, who already have tightly scheduled working hours, are being forced to work overtime and subsequently suffers fatigue in the next port of call. However, these indirect impacts arising from delays would require further investigation as there are a great deal of variables to account for.

5.3 Operational Potential of Data Sharing Concepts

5.3.1 Supporting Key Communication Personnel

A data sharing concept like PortCDM would help key communication personnel like agents or pursers to receive and forward information in a faster and more efficient way (Section 4.2.4). When working together with many different actors, keeping the most important data in a standardized format would help to improve situational awareness (Section 4.2.6.2). Most interviewees agreed that the information contained in the PCMF covers the most important data (Section 4.2.6.1).

The use of such communication methods would also require key communication personnel to adapt their work methods. For onboard pursers, this would arguably be rather easy as their work also includes other responsibilities than communication. For agents however, receiving and forwarding communications are a central part of their business offering. Due to the variety of required information, it is unlikely that agents will be fully replaced by technology. However, adopting a data sharing concept *like* PortCDM into their business model would likely help their capabilities and service offerings. It would also empower other actors to perform duties which are currently done by agents. An example would be a bunker barge being able to communicate directly with the cruise ship's chief engineer, saving several phone calls via the agent. This thesis suggests that in order to stay competitive, agents are advised to stay on top of technological innovations. Instead of regarding technological solutions as risks or inferior to human interaction, they should use them to improve their efficiency and service offering.

5.3.2 Facilitating Coordination in Complex Scenarios

The heterogeneity of the cruise environment and the lack of standardization leads to uncertainty when interacting with new actors. Thus, every new port call presents a challenge. This is reflected in several interviewees naming experience as important factor to handle a port call. Even within the same organization or in recurring situations, operational processes might differ depending on the involved personnel (Section 4.2.4). This results in an increased need for coordination and possible inefficiencies. The complexity increases in case of schedule deviations which require a high amount of coordination, depending on the number of involved actors, how early the deviation is known, and the impact on scheduled operations. This issue is exemplified by a cruise company employee stating that in such cases, representatives from different departments would come together and discuss the situation in person because *"nobody has a complete overview of what everybody exactly does".* These operations may include shore excursions, security matters, passenger/crew exchanges, scheduled maintenance, bookings of service providers and various other activities, all of which are managed by different departments and require contextual information (Section 4.2.3).

PortCDM would likely help to summarize and distribute some of that information, help to gain situational awareness in stressful situations and allow for better decision-making. This would help to mitigate the impact of any disturbance and execute timely corrective actions. In view of the number of involved actors in every port call, a standardized data format would also make communication faster and more transparent. Personal meetings as described in the above paragraph would be supported by this. Further, availability, accuracy and transparency of shared contextual data allow for improved situational awareness of deficiencies.

5.3.3 Facilitating IT Maturity for Smaller Organizations & Third Parties

A standardized data sharing concept would lower the entrance barrier to implement certain functionalities and connectivity to other actors for smaller organizations or new actors who are currently not integrated in the communication chain. In a scenario where a single data standard, e.g. the technical standard S-211 from PortCDM, has become widely distributed, such organizations would also have increased certainty in adopting to a common standard. Some organizations have implemented advanced coordination systems to cater to the needs of the cruise environment as described by the cruise company employee PC1 and the port PP3 (Section 4.2.4). However, these systems were described as tailor-made for the respective organization's needs. While large organizations have both financial and operational resources to build appropriate ICT systems on their own, this may pose a risk for smaller organizations.

Shore excursions and passenger flights are factors of uncertainty in the port call as shown by the data analysis in Section 4.1.4. Both are subject to various influences out of the cruise company's or the port's range of influence and it is difficult to monitor those influences. Disturbances can both affect customer satisfaction and the ship's schedule. Integrating these actors in a collaborative environment may help to monitor those operations and facilitate communications in the port call. Possible examples could be tour guides on the excursions using an app or airlines adapting the S-211 standard and automatically forwarding flight changes to actors in the port and the ship. In addition to reducing uncertainties, several interviewees described potential benefits if such information would be available for all actors (Section 4.2.7.3). Examples include tourist-related service providers like popular museums or taxis who could plan accordingly. As a result, a city might improve their tourist-handling capacity and could accommodate more cruise ships per day and potentially provide them with more positive impressions.

5.4 Strategic Potential of Data Sharing Concepts

5.4.1 Enabling Interaction with Other Microsystems

The use of integrated databases and standardized processes in the maritime sector might facilitate integration with other industries. There may be high potential in linking the cruise operation with operations within the city. This is supported by the "Smart City" concepts which aim at collecting data within the city and improving efficiency and connectivity (Novotný, Kuchta et al., 2014). Integrating these concepts might enable various possibilities for both port and urban processes. Integrating these concepts might enable various possibilities for both port and urban processes. For the cruise industry, the biggest improvement potential would likely be in supply logistics and tourist-related activities. As an example, shore excursions could be scheduled and monitored more efficient, avoiding disturbances like construction sites or including special events like festivals in the passenger experience (Section 4.2.7.3). Cruise companies may benefit by improving the service offering towards passengers. Municipalities would be enabled to build a more holistic tourism concept which caters towards economic, environmental and social sustainability goals by incorporating cruise activities into their city concept. Other possible uses of connecting port and city data could be enhanced emergency handling, improved coordination of public transportation or smart energy usage in case of ships' onshore power supply (Section 4.2.6.3).

Since the cruise market is a rather specialized sector, there can be a lack of suitable information for certain areas. Some information may only be available in databases designed for shipping or for tourism in general, which does not always meet the cruise market's specific requirements. Using a certain standard like S-211 would make it easier to build new platforms which integrate information from both PortCDM and other databases and information feeds (Section 4.2.7.1).

Standardizing and publicizing the requirements to integrate within the maritime domain may allow entirely new sectors to build collaborations and explore synergies which have not been thought of before. A corresponding example in cargo shipping would be high-fashion manufacturers including shipping processes in their business planning which would be facilitated with transparent and standardized processes (Section 4.2.7.3). Transparency and insight into supply chains would add considerable value to organizations and customers, allowing them to benefit from having accurate information available. A possible equivalent to the cruise sector might be travel or crewing agencies.

As a system of records, PortCDM could provide enhanced transparency to aid the validation of expense claims and facilitate the handling of payments. This could benefit financial service providers like banks or insurance companies. In legal terms, such records might be used as proof when settling legal disputes and reduce the need for paper-based documents, thus reducing administrative work (Section 2.4.3).

Finally, given the large amount of operation onboard a cruise ship, which involves deck, engine, galley, laundry, entertainment, HR, onboard-revenue, shore operation and many more departments, some with more than hundred crew members each, there may be numerous other applications which have not been touched upon in these extrapolated considerations based on exploratory analyses of the thesis data.

5.4.2 Competitive Advantage in a Changing Market

There is a number of industries where optimization of value networks has given a strong competitive advantage, and this may translate for shipping companies and ports. There are various developments in the cruise market which may indicate that competitiveness will become stronger. While the cruise market is growing, and more and bigger ships are built, the accessibility of ports may decrease due to size restrictions, security concerns or protest of local inhabitants. Furthermore, the market may become saturated at one point, depending on the cruise companies' ability to reach new target groups as passengers, to sustain existing passengers as loyal customers and to keep up a positive public image regarding environmental concerns.

In that environment, a cruise company which is able to use data sharing opportunities to their full extent and thus to be more efficient, e.g. by collecting and analyzing data or optimizing berth/ itinerary scheduling, may provide competitive advantages. For ports and service providers, using a standardized system may provide a certain degree of transparency for their customers, i.e. the ships. An example would be the PortCDM maturity framework which would allow other actors to know what to expect and align their operation with this actor in the most suitable way, e.g. by sending relevant information in a S-211 format.

5.4.3 Enabling Standardization & Collaboration

There seems to be a general need for more standardization and collaboration in the maritime sector. Those were the main concerns raised in the context of the e-Maritime initiative, presented in Section 2.3.3. The interviews confirmed this and showed the need of various actors for easy and transparent access to information revolving around the port call, such as port or ship information. Some interviewees took own initiatives to collect and exchange such information, but most expressed their desire for a more standardized approach. Examples included a central berth booking platform and standardized administrative processes relating to vessel clearance (Sections 4.2.7.1 & 4.2.7.2).

The need for more harmonization and simplification is especially evident in maritime reporting procedures. A reporting formalities directive, calling for streamlined national single windows to facilitate standardized reporting has thus far failed in many ways to achieve its intent, mainly due to unclear governance (Section 2.3.4.1). Initial evaluations showed disappointing results, concluding that far too few processes have been harmonized on an EU level, with member states adopting their own uniquely differentiated single windows. For the maritime single windows to truly improve operational efficiency on a larger scale, they need to be standardized with interfaces designed from the same blueprint and ask for the same reporting formalities in every country. Such an EU-wide harmonization of single windows would facilitate significant opportunities to harmonize and standardize other ICT applications as well, to fit seamlessly into the port community systems of multiple ports.

Many systems in the port environment would benefit from a standardized message format. Various organizations have implemented advanced coordination systems which fit their needs. However, these are often different and lack the ability of integration with other systems. Examples include ports with sophisticated Port Community Systems with little or no connectivity to key neighboring ports (Section 2.3.3). This matches the description of the maritime sector as a self-organizing system where most actors are focused on their own operation. Establishing industry-wide standards would not be profitable for single actors but may result in efficiencies on a larger scale.

The successful implementation and widespread adaptation of innovative technologies is a complex process and will require different preconditions and industry drivers. It seems unlikely that the cruise ship sector will serve as a major driver for a widespread PortCDM-like adaptation due to its already high efficiency and the comparably small market. However, if PortCDM would reach a widespread distribution, this might drive a more collaboration-driven culture in the maritime sector. Organizations might be encouraged to incorporate connectivity into their systems and third parties could be enabled by common standards to offer specialized services.

5.4.4 Improving Business Models with Data

The use of a certain data standard may enable various possibilities to improve existing business models, as e.g. happened before with the widespread use of AIS data enabling new monitoring or analysis tools. Collecting data can enable analysis and subsequent identification of possible weak links to implement improvement measures. While most interviewees already did this out of company policy or “best practice”, as mentioned in Section 4.2.6.4, using a standardized system would facilitate and improve these processes. A database of historical records would allow the identification of weak points and creating key performance

indices. A more advanced step would be the use of quality management methodologies, such as “Total Quality Management”, which strongly depend on data to monitor and improve business performance.

5.5 Challenges

The process of digital innovation is complex. Its success depends on a combination of various factors, including appropriate technical infrastructure, market demand, economic benefits, governance, enabling co-innovation and including up- and downstream stakeholders. Drawing on previous processes of implementing innovation in the maritime sector, key drivers are organizations which are able to adopt innovation to their advantage and into appropriate technical, financial and organizational solutions (Section 2.1.1). Findings from the PortCDM Validation Project and the upcoming STEAM project indicate that this may be accomplished by shipping companies and ports operating under high uncertainty (Sections 2.4.3 & 2.4.4) who might benefit from JIT operation.

However, the statements made by a cruise company employee in the interviews (Section 4.2.4) and the high rate of replacement ports in case of short-term cancellations (Section 4.1.3.4) indicate that the company structures in place work well to enable a comparable high efficiency. Further, the cruise market is oligopolistic (Section 2.2.1) and interview comments suggest that organizations at a certain point implement their own, tailor-made coordination systems (4.2.4). This might make it difficult for one data sharing standard to become widespread and for external parties to integrate into such custom systems.

When ports decide to adopt to a certain data sharing concept in regional operations, the success of the implementation depends also on the ability of local change agents to communicate their capabilities and potential operational benefits in a transparent way. The PortCDM concept for example achieves this with a maturity framework. Much like the implementation of a Port Community System, the success of a data standard requires widespread participation by multiple parties to achieve maximum benefits for the collective. There will be actors reluctant to change, whom do not see any immediate internal benefit from changing their procedures, but whose participation will greatly enhance the overall operation. These actors need to be demonstrated the clear benefits of harmonized procedures, and in certain cases be offered sponsorships such as financial aid or IT expertise by dominant orchestrators to ensure connectivity.

Furthermore, when a data standard becomes an integral part of information platforms, such as PCMF (S-211) in the envisioned STEAM project, a modular implementation strategy, by starting small and adding on as developments and functional accuracy are assessed is a prudent progression. For every module implemented, the objectives and tangible benefits of its content should be carefully communicated to all involved actors, thus ensuring less reluctance to adapt their business practices and applications to interface with the platform. Safeguarding the further support of involved actors is an important objective through any ICT implementation. The risk of potential rejections needs to be mitigated by quality control and proper preparation of actors.

If a standardized CDM concept enters an industrial stage of widespread usage, the cruise sector could possibly adapt to existing solutions with relatively low effort. Coordination with port actors and maritime service providers via a certain message standard for cruise actors would likely be similar to cargo shipping-related processes. However, this thesis indicates potential in improving coordination with tourist-related operations with different requirements. It is difficult to predict who would be the main driver in enabling this.

6 Conclusion

The purpose of this thesis was to analyze the potential of data sharing concepts in the cruise ship sector. To do this, the environment and inefficiencies of a cruise ship port call were analyzed to identify inefficiencies and points for improvement. This was done using a data set of 1648 cruise ship schedule deviations and 11 interviews of professionals from the shipping sector.

The results show that the port call of a cruise ship is highly heterogeneous and involves several simultaneous operations where various actors interact. The common business model relies on a high operational accuracy and tight integration of these operations within the port schedule. This is reflected in the overall operational efficiency where, based on the quantitative data, only every 25th port call experienced any delay and only every 50th port call was cancelled. This is much more efficient than other shipping sectors, partially due to a well-functioning long-term planning process. Major inefficiencies were non-influenceable events (adverse weather, technical malfunctions), operations outside of the port environment (shore excursions, passenger flights) and port coordination (traffic congestion, berth allocation).

Due to the dependency on accuracy, any schedule deviation was deemed as negative impact on passenger satisfaction and financial revenue. Due to the number of involved actors and the differences in ports' and ships' structures, key communication personnel (agents, pursers) play a crucial role in that environment to mediate and to forward information. Thus, most actors depend on their communication capability and experience to gain situational awareness and synchronize their plans. On an organizational level, it becomes profitable for organizations to implement advanced coordination systems which facilitate monitoring and sharing of operational data. These are usually specifically tailored towards the organization's needs and are not designed to integrate with other organizations, partially due to a lack of standards.

This thesis has looked into the PortCDM concept as a recent example of a data sharing concept which aims to improve efficiency and situational awareness for port call actors through real-time data sharing. This includes the use of a data standard and the possibility of back-end integration which shall enable a widespread distribution and connectivity. One of the central promises of a collaborative decision-making approach, JIT operations, would have little value for the cruise sector due to its already high accuracy. There is, however, potential to improve the port call by providing real-time, standardized data to all actors.

This thesis identified the key communication personnel in the value chain as main benefactors as they could improve their operational capability. This would also imply a necessity for agents to adapt their business model. Further, although schedule deviations are relatively rare, they do result in complex situations requiring a high amount of contextual information to be exchanged in a short amount of time between multiple actors. The availability of sharing the most important information, such as timestamps, would reduce the complexity and facilitate decision-making based on reliable and accessible information. In return, this could help to mitigate the impact by schedule deviations.

For actors outside of the port/ship environment, sharing port call-related data would reduce uncertainties and help to include them closer in the communication chain. This would be most beneficial for shore excursions and passenger flight information as these have shown to be major inefficiencies and uncertainties. Other actors, including local businesses, would be able to use such information to adapt their planning towards passenger flows.

On an organizational level, the ability to easily collect data would enable organizations to monitor performance and create benchmarks, possibly using modern data-dependent quality management methodologies. For smaller organizations, the distribution of a common standard would help to acquire advanced IT maturity. Further, adopting capabilities enabled by enhanced data sharing in their business model might help organizations to gain competitive advantages. Ports could improve their service offering towards arriving ships while cruise companies could optimize their itinerary planning processes.

In the past, innovations in the shipping sector have initiated standardization processes and enabled further innovation. An example is the standardized use of AIS which allowed collecting data and offering monitoring services. CDM concepts could enable similar developments. Using the data gathered in a standardized system of records, financial services could benefit by facilitating handling of expense claims. For the cruise sector, this could enable tourism-oriented services which would help cities to incorporate cruise ship activities in a holistic tourism concept. If digital transformation in cities advances, e.g. through a “Smart City” concept, port-related data could help to improve public transportation flows or to optimize the energy supply. Such developments would also potentially drive a culture change within the maritime sector towards more collaboration and standardization. This would in return help streamlining other processes like standardized clearance processes on a regional level.

For future research, this thesis might be used to look further into how geographical differences may influence operational efficiency and how the ICT infrastructure may be adapted accordingly. Researchers with non-maritime backgrounds might be interested to analyze potential benefits of using data sharing to enable synergies between the maritime and other sectors. This thesis described some possible synergies, with the Smart City concept, tourism and financial services being named as non-exhaustive examples. The example of high-fashion manufacturers implementing cargo shipping processes in their business operation suggests that there may be other opportunities not yet foreseen by industry professionals. If PortCDM reaches a more industrial stage, data gathered from early adopters may be used to research further into how future implementation and innovation processes can be improved.

7 Appendices

7.1 Information System Architectures

Traditionally, the following 4 architectures depicted graphically below in Figure 31 have been predominant throughout the history and development of information systems (Srour, van Oosterhout et al., 2008 Zuidwijk):

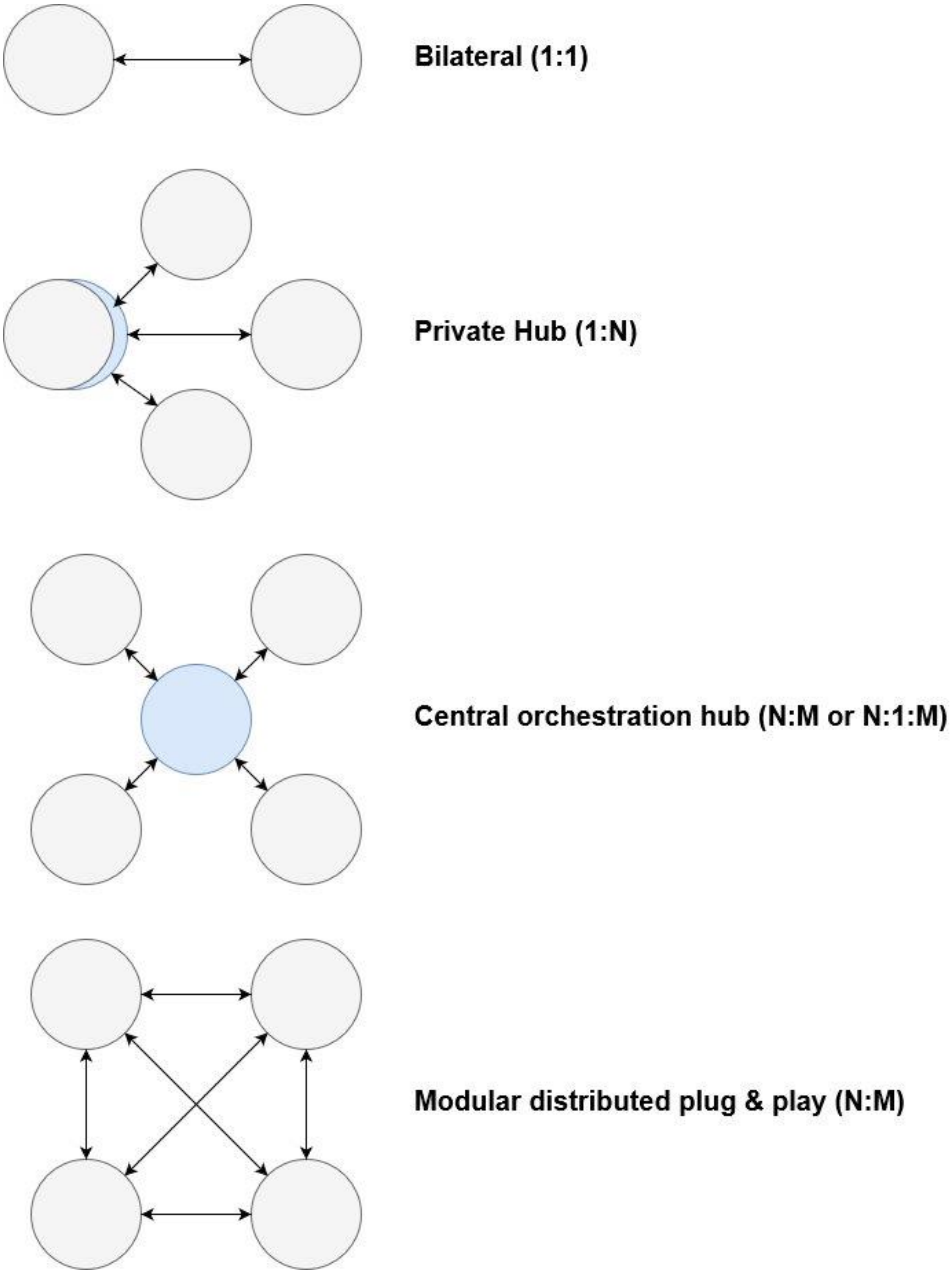


Figure 31 - Most common inter-organizational architectures (based on (Srour et al. 2008))

- **Bilateral (1:1)**
  - Point to point connectivity in its most basic form between two established trading partners to exchange information.
- **Private hub (1:N)**
  - A hub structure generally initiated by a strong party that allows connectivity for multiple partners with minimal linkages. Access to the hub is standardized and internal applications only need one connection point. Each party connects through the hub, and connection with another party is established through the hub.

- **Central orchestration hub (N:M or N:1:M)**
    - Structurally alike to a Private hub, but generally run by a single centralized, independent operator. This kind of architecture is most efficient if there are no dominant parties in the industry.
- **Modular distributed plug & play architecture (N:M)**
    - A M2M (machine to machine) structure absent permanent linkages, where parties plug & connect when interactions and exchanges of information is needed. For this type of architecture, standardization is critical.

7.2 Data of Quantitative Analysis in PortCDM Validation Project

	BULK CARRIER	CONTAINER	OFFSHORE	OTHER	PASSENGER	RO-RO	TANKER
Barcelona	268	754	5	173	406	1379	279
Brofjorden	2			19	4		1270
Gothenburg	2363	1353	6	265	94	7394	5546
Limassol	294	623	314	281	72	190	279
Sagunto	752	180		13		356	35
Stavanger	4857	512	2304	1356	377	1717	526
Umeå	196	111		3	7	219	107
Vaasa	19			3		6	3
Valencia	449	2946	157	62	269	2116	220

Figure 32 – Overview of analyzed port calls during the PortCDM Validation Project (Lind, Haraldson et al., 2019)

7.3 Process of Cleaning the Quantitative Data Set

1. Compiled weekly reports in one file
2. Cleaned any typos which prevented correct sorting of data into the preconfigured categories, e.g. “Weater” instead of “Weather”
3. Filled blank cells and corrected minor errors:
4. Cancelled/Missed/Delayed: filled in with context described in “Other Impacts/Comments”
5. Arrival/Departure in case of delays: filled in with context described in “Other Impacts/Comments”. In few cases, it was explicitly stated. In other cases, it was apparent from the context or the nature of the delay. Example: One incident with a delay was described in “Other Impacts/Comments” with “due to ongoing bunker operation”, without referring if the incident was at arrival or departure. In such case, it was assumed to be at departure.
6. Time of Delay (if delay, in hours): filled in with context described in “Other Impacts/Comments”.
7. Replacement Port: filled “No Replacement Port” if left blank
8. Reason: filled in with context described in “Other Impacts/Comments”, if no obvious reason then category “Other” was used.
9. Impact on Shorex: In a relatively large portion of the incidents classified as “Cancelled” or “Missed”, approx. 24%, the description for this category was stated as either “No”, “Unknown” or left blank. Although with the description for this category in the operator’s guidance, one would assume that cancelling or missing a port would be linked directly to affecting shore excursions, there was insufficient information to prove this assumption. Therefore, only blank fields were filled with “Unknown Impact on Shorex”.
10. In approx. 8% of all incidents, various fields in the “Cancelled/Missed” categories were found which stated no or unknown impact on Shorex. As the cancellation or missing of a port would directly

result in affecting shore excursions and information found in other fields showed nothing which would prove the opposite, these fields were marked as ‘‘Impact on Shorex’’ instead.

11. Additional, various entries with Reason: ‘‘Other’’ were found which were clearly identifiable as ‘‘PL/O’’. The majority of these cases included delayed flights, delayed port operation or delayed shore excursions. As all of these cases are also clearly defined as PL/O in the operator’s guide, therefore these were assumed to be faulty entries and were corrected as PL/O entries and subsequently arranged in the additional subgroups.

7.4 Analysis of Cruise Ship Itineraries

No	ship	at sea	port calls
1	aidaaura	165	200
2	aidadiva	108	257
3	aidaluna	131	234
4	allure of the seas	141	224
5	Braemar	146	219
6	carnival breeze	146	219
7	carnival conquest	109	256
8	carnival inspiration	101	264
9	Carnival magic	105	260
10	carnival splendor	172	193
11	carribean princess	121	244
12	celebrity eclipse	146	219
13	celebrity infinity	149	216
14	celebrity millenium	144	221
15	celebrity reflection	133	232
16	celebrity solstice	145	220
17	costa fascinosa	75	290
18	Costa Favolosa	103	262
19	costa mediterranea	95	270
20	costa neoclassica	120	245
21	crown princess	116	249
22	golden princess	131	234
23	Grand Princes	169	196
24	harmony of the seas	156	209
25	liberty of the seas	139	226
26	majestic princess	74	291
27	norwegian dawn	168	197
28	norwegian epic	94	271
29	Norwegian Getaway	122	243
30	norwegian joy	104	261
31	norwegian spirit	80	285
32	oasis of the sea	88	277
33	oceania nautica	120	245
34	pacific eden	186	179
35	Royal princess	105	260
36	sea princess	173	192
37	seabourn ovation	73	292
38	seven seas explorer	91	274
39	silver muse	135	230
40	Veendam	112	253
	Average	**125**	**240**

Figure 33 – Analysis of 40 publicly available, randomly selected cruise ship itineraries 2018. Source: own compilation based on data from (Crew Center, 2018)

Data Set			
38	Ships		
3	Years		
1648	Incidents		
Publicly Available Itineraries			
240	Port Calls/Year		
Calculation			
38	Ships have	9120	Port Calls/Year
38	Ships have	27360	Port Calls in 3 Years
Incident Rate (Incidents/Port Calls in 3 Years*100)			6,02%

Figure 34 – Calculation of average incident rate based on the quantitative data set analyzed in section 4.1 and above analysis of itinerary data

7.5 DSP Subcategories

Type	Description	Data Sharing Potential
Port Deletion	Any port taken out of rotation without replacement port before cruise started	1
Intended Delay Arrival	Any intended delay at departure. E.g. planned technical maintenance during sea passage, lack of early embarking passengers.	2
Intended Delay Departure	Any Delay which was expected or decided based on expected issues. E.g. planned maintenance, compensation for late arrival, any scheduled measure to improve guest satisfaction.	2
Port Deletion short-term	Any port taken out of rotation without replacement port during the cruise	2
Rerouting Long term	Any port replaced with another port before cruise has started.	2
PL/O - Tender Operation	Any delay due to Tender Operation. Lower score than other Port operation as ship is at anchor and no coordination for linesmen/tugs is required.	2
PL/O - Administratitve	Any issues with immigration, clearance, etc.	3
PL/O - Garbage/Provision/Luggage	Description in Other Impacts/Comments. Delayed Departure due to Garbage/Provision/Luggage Operation	3
PL/O - Port Traffic/Berth Assignment	E.g. conflicting traffic with other ships, other ships occupying the berth, etc.	3
Problems in previous port	All events caused directly by an event from the previous port.	3
PL/O - Tug/Pilot/Linesmen	Delay or miss due to unavailability of tugs/pilots/linesmen	3
Unintended Delay Departure	Any unscheduled delay at departure which does not fall in other categories & does not include actors besides ship & port. E.g. technical failure, weather.	3
Unintended Delay Arrival	Any unscheduled delay at arrival which does not fall in other	3
PL/O - Bunker Ops	Any delay due to bunker operation	4
PL/O - Delayed Flight	Description in Other Impacts/Comments. Delayed departure	4
Rerouting Short term	Any port replaced with another port during the cruise.	4
PL/O - Shore Excursions	Delay due to delayed shore excursions sold and organized by company.	4
Unintended Delay Arrival (ext)	Any unscheduled delay at arrival which does not fall in other categories and most likely impacted port operation with external actors, e.g. shore excursions.	4
Unintended Delay Departure (ext)	Any unscheduled delay at departure which does not fall in other categories & includes external actors besides ship & port. E.g. medical emergencies, security incidents, public transportation breakdown.	4

1	long term changes, little information exchange required
2	long term changes & requires information exchange/short term change, requires little information exchange
3	short term changes, requires information exchange between ship & port
4	short term changes, requires information exchange between ship, port & external actor

Figure 35 – overview and description of subcategories with assigned DSP factor

7.6 Data Tables of Analyzed Data Set

7.6.1 Overview

	General			Delays			Shorex			Home Port		Repl. Port	DSP
	No. Events	Rel. %	Total %	Total Time of Delay [h]	Average Delay [h]	St.Dev Delay [h]	Shorex impact YES	Shorex UNKNOW N	Shorex Impact NO	No. HP	Likelihood of resp. Reason affecting HP	Likelihood of resp. Reason having Repl. Port	Average Data Sharing Potential Factor
Cancelled	**132**	**8,0%**	**8,0%**				**65%**	**20%**	**15%**	**6**	**5%**	**73%**	**1,8**
Other	7	5,3%	0,4%				43%	57%	0%	0	0%	100%	2,0
Port Logistics / Operational	20	15,2%	1,2%				40%	20%	40%	2	10%	80%	2,0
Search & Rescue (SAR)	1	0,8%	0,1%				0%	100%	0%	0	0%	100%	2,0
Technical	1	0,8%	0,1%				100%	0%	0%	0	0%	100%	2,0
Weather	103	78,0%	6,3%				72%	17%	12%	4	4%	69%	1,7
Delay Arrival	**307**	**18,6%**	**18,6%**	**1137,2**	**3,7**	**4,0**	**23%**	**35%**	**41%**	**115**	**37%**	**0%**	**3,4**
Medical Emergency	13	4,2%	0,8%	26,8	2,1	1,0	23%	38%	38%	3	23%		3,3
Other	13	4,2%	0,8%	42,9	3,3	3,8	8%	38%	54%	3	23%		2,8
Port Logistics / Operational	104	33,9%	6,3%	228,2	2,2	2,0	14%	33%	53%	46	44%		3,5
Search & Rescue (SAR)	4	1,3%	0,2%	16,9	4,2	2,9	25%	50%	25%	1	25%		3,8
Security	1	0,3%	0,1%	17,0	17,0	0,0	0%	100%	0%	0	0%		4,0
Technical	30	9,8%	1,8%	96,2	3,2	2,8	33%	30%	37%	6	20%		3,2
Weather	142	46,3%	8,6%	709,2	5,0	4,8	30%	37%	34%	56	39%		3,5
Delay Departure	**784**	**47,6%**	**47,6%**	**2766,54**	**3,5**	**5,1**	**4%**	**11%**	**84%**	**342**	**44%**	**0%**	**3,4**
Health	1	0,1%	0,1%	1,5	1,5	0,0	0%	0%	100%	0	0%		3,0
Medical Emergency	42	5,4%	2,5%	83,1	2,0	1,2	2%	5%	93%	14	33%		4,0
Other	53	6,8%	3,2%	180,2	3,4	4,6	6%	13%	81%	26	49%		3,1
Port Logistics / Operational	412	52,6%	25,0%	993,6	2,4	2,3	3%	9%	88%	215	52%		3,7
Search & Rescue (SAR)	2	0,3%	0,1%	12,0	6,0	2,5	0%	100%	0%	1	50%		3,5
Security	6	0,8%	0,4%	12,0	2,0	1,7	0%	0%	100%	1	17%		4,0
Technical	118	15,1%	7,2%	546,2	4,6	8,8	4%	11%	85%	30	25%		2,9
Weather	150	19,1%	9,1%	938,0	6,3	6,3	8%	19%	73%	55	37%		3,0
Missed	**425**	**25,8%**	**25,8%**				**78%**	**16%**	**6%**	**11**	**3%**	**68%**	**3,4**
Health	2	0,5%	0,1%				0%	100%	0%	0	0%	0%	2,0
Medical Emergency	8	1,9%	0,5%				100%	0%	0%	0	0%	38%	2,8
Other	4	0,9%	0,2%				25%	25%	50%	0	0%	50%	3,0
Port Logistics / Operational	35	8,2%	2,1%				54%	17%	29%	0	0%	83%	3,7
Search & Rescue (SAR)	1	0,2%	0,1%				100%	0%	0%	0	0%	0%	2,0
Security	5	1,2%	0,3%				80%	0%	20%	0	0%	100%	4,0
Technical	22	5,2%	1,3%				82%	18%	0%	0	0%	68%	3,4
Weather	348	81,9%	21,1%				81%	15%	4%	11	3%	68%	3,4
Grand Total	**1648**	**100,0%**	**100,0%**	**3903,74**	**3,6**	**4,8**	**32%**	**18%**	**51%**	**474**	**29%**	**23%**	**3,3**

Figure 36 – Overview of analyzed data set

7.6.2 Distribution of Incidents over Time

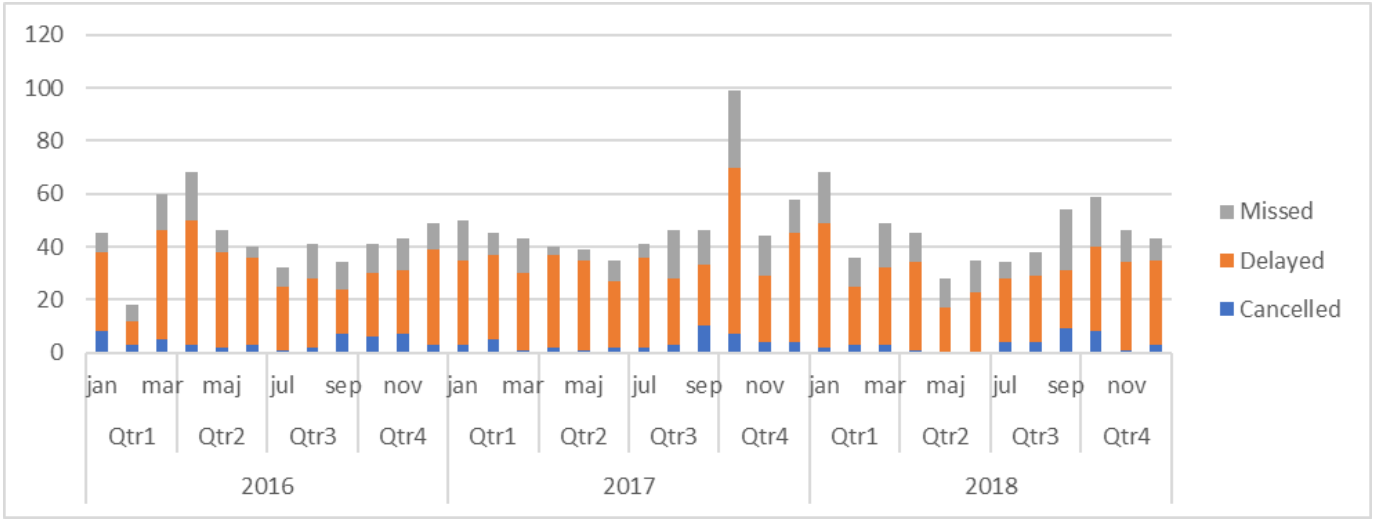


Figure 37 – Incidents sorted over time

7.6.3 Port Type

	No. Total Events	Total Events Rel.%	No. HP affected	HP Rel. %
Cancelled	**132**	**8,0%**	**6**	**1,3%**
Weather	103	78,0%	4	66,7%
Port Logistics / Operational	20	15,2%	2	33,3%
Technical	1	0,8%	0	0,0%
Other	7	5,3%	0	0,0%
Search & Rescue (SAR)	1	0,8%	0	0,0%
Delay Arrival	**307**	**18,6%**	**115**	**24,3%**
Weather	142	46,3%	56	48,7%
Port Logistics / Operational	104	33,9%	46	40,0%
Technical	30	9,8%	6	5,2%
Other	13	4,2%	3	2,6%
Medical Emergency	13	4,2%	3	2,6%
Search & Rescue (SAR)	4	1,3%	1	0,9%
Security	1	0,3%	0	0,0%
Delay Departure	**784**	**47,6%**	**342**	**72,2%**
Port Logistics / Operational	412	52,6%	215	62,9%
Weather	150	19,1%	55	16,1%
Technical	118	15,1%	30	8,8%
Other	53	6,8%	26	7,6%
Medical Emergency	42	5,4%	14	4,1%
Security	6	0,8%	1	0,3%
Search & Rescue (SAR)	2	0,3%	1	0,3%
Health	1	0,1%	0	0,0%
Missed	**425**	**25,8%**	**11**	**2,3%**
Weather	348	81,9%	11	100,0%
Security	5	1,2%	0	0,0%
Search & Rescue (SAR)	1	0,2%	0	0,0%
Medical Emergency	8	1,9%	0	0,0%
Technical	22	5,2%	0	0,0%
Other	4	0,9%	0	0,0%
Health	2	0,5%	0	0,0%
Port Logistics / Operational	35	8,2%	0	0,0%
Grand Total	**1648**	**100,0%**	**474**	**100,0%**

Figure 38 – Incidents sorted by Port Type

7.6.4 Shorex Impact

It is not surprising that cancellations/misses have the highest chance of impacting shore excursions. It may be actually more surprising that both cancellations and misses have a number of cases (15% and 6%, respectively) which claim to have no effect at all. While this may be due to input error by the data collectors, it could also be that appropriate replacements for missed excursions have been found. The fact that the impact on shore excursions is lower within cancellations than in misses would support this assumption. As it was not possible to verify either assumption, it is assumed that the entries are correct.

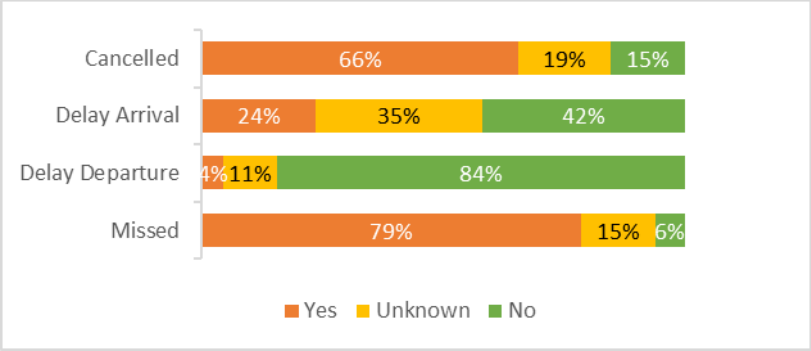


Figure 39 – Shorex Impact Distribution

Delays at arrival showed only in 41% of all cases to not affect Shorex which seems logical as shore excursions are usually scheduled tightly within the port laytime. Delays at departure had the lowest effect overall. This seems plausible as well since scheduled excursions would be able to return in time.

Dividing these categories more detailed by reason, it shows various things.

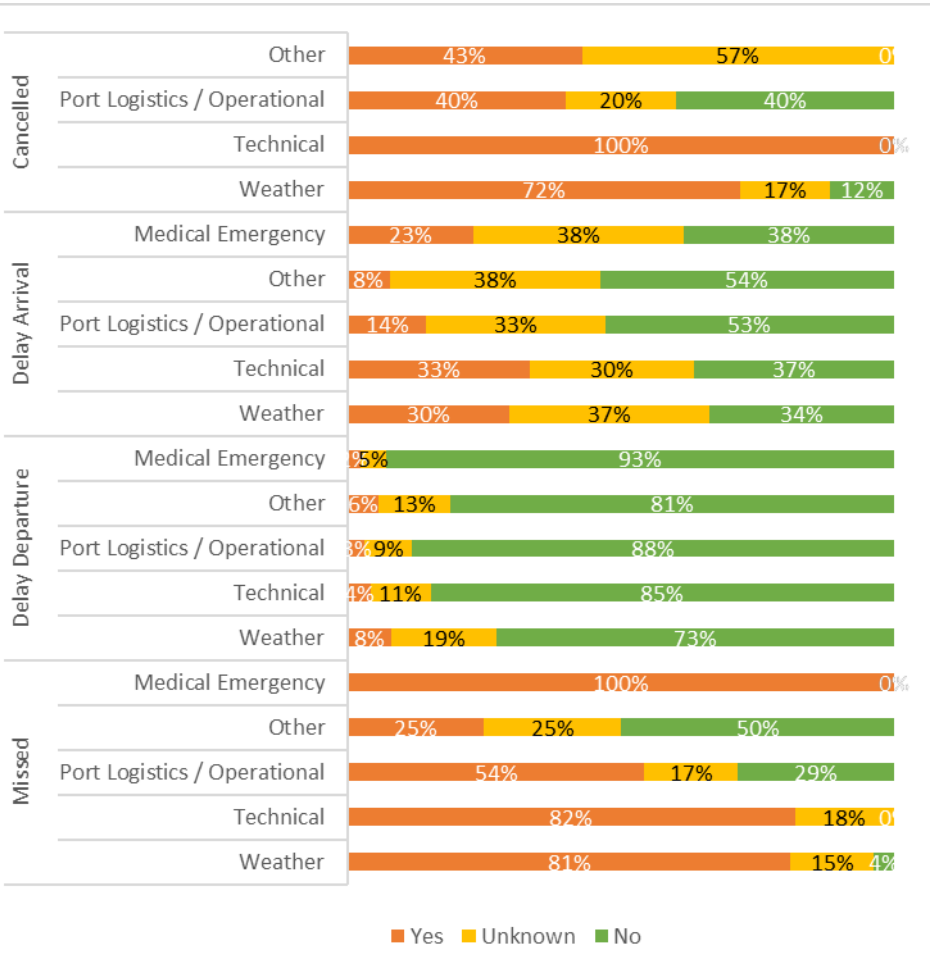


Figure 40 – Shorex Impact by Nature & Reason

Generally, various categories show a large percentage of "Unknown impact on Shorex" and therefore it is difficult to make clear statements of a correlation between reasons and impact on Shorex. Overall, the majority of reasons mirror the general trend of the above and there are few clear trends to any reason having a constant positive or negative effect on the respective incident which spreads over all categories.

Looking more closely at the Delay Arrival category, it stands out that security and SAR have the highest chance of not affecting Shorex, which can however be explained to the low number of incidents (1 & 4 respectively). More interestingly, the two main reasons for causing a delay at arrival, weather and PL/O differ strongly, with weather causing more impact on Shorex than PL/O.

The Delay Arrival category may be the most interesting category here, as it can be argued that reducing the impact of such a delay would increase the chances of not impacting shore excursion. Looking at the Shorex impact by hours of delay during a delay at arrival, a quite big difference can be detected between delays of more and less than three hours. Arrival delays of 1-3h have 52% chance of not affecting Shorex, while every delay with >3h has a 30% chance or less. However, again due to the high number of entries with "Unknown Impact", it is hard to make clear assumptions.

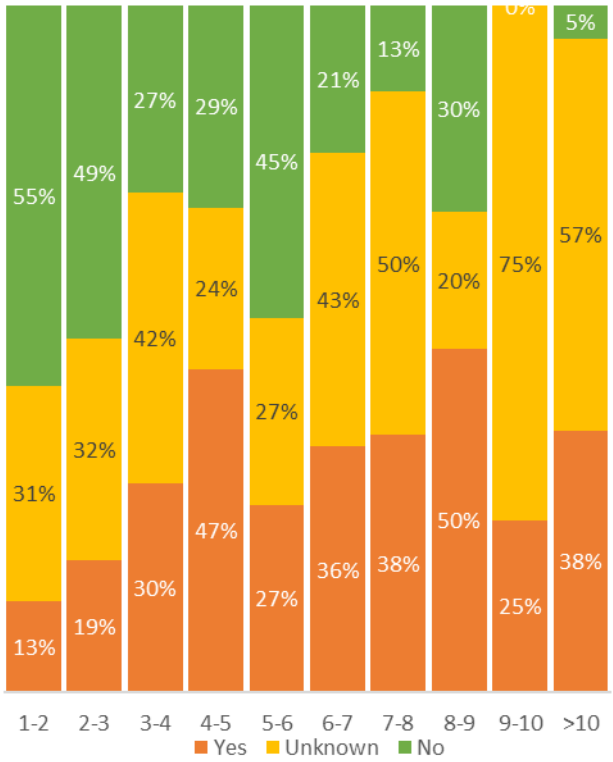


Figure 41 – Shorex Impact at Delay Arrival, divided by Hours of Delay

Row Labels	Sum of Counter	Shorex being affected "Yes"	Shorex being affected "Unkown"	Shorex being affected "No"	Shorex Rel %	Shorex Total %	Likelihood of Reason affecting Shorex	Likelihood "Unkown"	Likelihood not affecting Shorex
Cancelled	**132**	**86**	**26**	**20**	**16,38%**	**16,38%**	**65%**	**20%**	**15%**
Other	7	3	4	0	3,49%	0,57%	43%	57%	0%
Port Logistics / Operational	20	8	4	8	9,30%	1,52%	40%	20%	40%
Search & Rescue (SAR)	1	0	1	0	0,00%	0,00%	0%	100%	0%
Technical	1	1	0	0	1,16%	0,19%	100%	0%	0%
Weather	103	74	17	12	86,05%	14,10%	72%	17%	12%
Delay Arrival	**307**	**72**	**108**	**127**	**13,71%**	**13,71%**	**23%**	**35%**	**41%**
Medical Emergency	13	3	5	5	4,17%	0,57%	23%	38%	38%
Other	13	1	5	7	1,39%	0,19%	8%	38%	54%
Port Logistics / Operational	104	15	34	55	20,83%	2,86%	14%	33%	53%
Search & Rescue (SAR)	4	1	2	1	1,39%	0,19%	25%	50%	25%
Security	1	0	1	0	0,00%	0,00%	0%	100%	0%
Technical	30	10	9	11	13,89%	1,90%	33%	30%	37%
Weather	142	42	52	48	58,33%	8,00%	30%	37%	34%
Delay Departure	**784**	**34**	**89**	**661**	**6,48%**	**6,48%**	**4%**	**11%**	**84%**
Health	1	0	0	1	0,00%	0,00%	0%	0%	100%
Medical Emergency	42	1	2	39	2,94%	0,19%	2%	5%	93%
Other	53	3	7	43	8,82%	0,57%	6%	13%	81%
Port Logistics / Operational	412	13	36	363	38,24%	2,48%	3%	9%	88%
Search & Rescue (SAR)	2	0	2	0	0,00%	0,00%	0%	100%	0%
Security	6	0	0	6	0,00%	0,00%	0%	0%	100%
Technical	118	5	13	100	14,71%	0,95%	4%	11%	85%
Weather	150	12	29	109	35,29%	2,29%	8%	19%	73%
Missed	**425**	**333**	**66**	**26**	**63,43%**	**63,43%**	**78%**	**16%**	**6%**
Health	2	0	2	0	0,00%	0,00%	0%	100%	0%
Medical Emergency	8	8	0	0	2,40%	1,52%	100%	0%	0%
Other	4	1	1	2	0,30%	0,19%	25%	25%	50%
Port Logistics / Operational	35	19	6	10	5,71%	3,62%	54%	17%	29%
Search & Rescue (SAR)	1	1	0	0	0,30%	0,19%	100%	0%	0%
Security	5	4	0	1	1,20%	0,76%	80%	0%	20%
Technical	22	18	4	0	5,41%	3,43%	82%	18%	0%
Weather	348	282	53	13	84,68%	53,71%	81%	15%	4%
Grand Total	**1648**	**525**	**289**	**834**	**100,00%**	**100,00%**	**32%**	**18%**	**51%**

Figure 42 – Overview of Shorex Impact by Categories "Impact", "Unknown Impact", "No Impact"

7.6.5 DSP Overview

DSP Categories	No. Events	Rel.%	Total %	Average Delay [h]	Shorex Impact	Shorex Impact Unkown	No Shorex Impact
1=low	**29**	**2%**	**2%**		**83%**	**0%**	**17%**
Port Deletion	29	100%	2%		83%	0%	17%
2=fairly low	**299**	**18%**	**18%**	**2.8**	**61%**	**14%**	**25%**
Port Deletion short-term	127	42%	8%		91%	6%	3%
Rerouting Long-term	103	34%	6%		60%	25%	15%
Intended Delay Departure	54	18%	3%	3.2	7%	9%	83%
PL/O - Tender Operation	8	3%	0%	1.6	0%	0%	100%
Intended Delay Arrival	7	2%	0%	1.8	0%	57%	43%
3=fairly high	**590**	**36%**	**36%**	**3.8**	**7%**	**21%**	**72%**
Unintended Delay Departure	249	42%	15%	5.4	6%	15%	79%
Unintended Delay Arrival	122	21%	7%	2.4	0%	25%	75%
PL/O - Port Traffic/Berth Assignment	107	18%	6%	2.6	5%	26%	69%
Previous Delay	83	14%	5%	3.0	28%	30%	42%
PL/O - Administrative	23	4%	1%	2.3	0%	13%	87%
PL/O - Tug/Pilot/Linesmen	6	1%	0%	1.5	0%	0%	100%
4=high	**730**	**44%**	**44%**	**3.4**	**38%**	**17%**	**45%**
Rerouting Short-term	287	39%	17%		72%	20%	8%
Unintended Delay Departure (ext)	142	19%	9%	3.0	4%	6%	90%
Unintended Delay Arrival (ext)	94	13%	6%	6.5	59%	41%	0%
PL/O - Delayed Flight	88	12%	5%	2.4	0%	5%	95%
PL/O - Shore Excursions	54	7%	3%	1.6	15%	11%	74%
PL/O - Bunker Ops	43	6%	3%	2.2	0%	14%	86%
PL/O - Garbage/Provision/Luggage	22	3%	1%	3.6	0%	5%	95%
Grand Total	**1648**	**100%**	**100%**	**3.6**	**32%**	**18%**	**51%**

Figure 43 – Overview of DSP Categories, average time of delay and Shorex impact

In terms of impact, most PL/O categories are below the average time of delay (3,5h for arrival; 3,7h for departure), with most being below 2,5h.

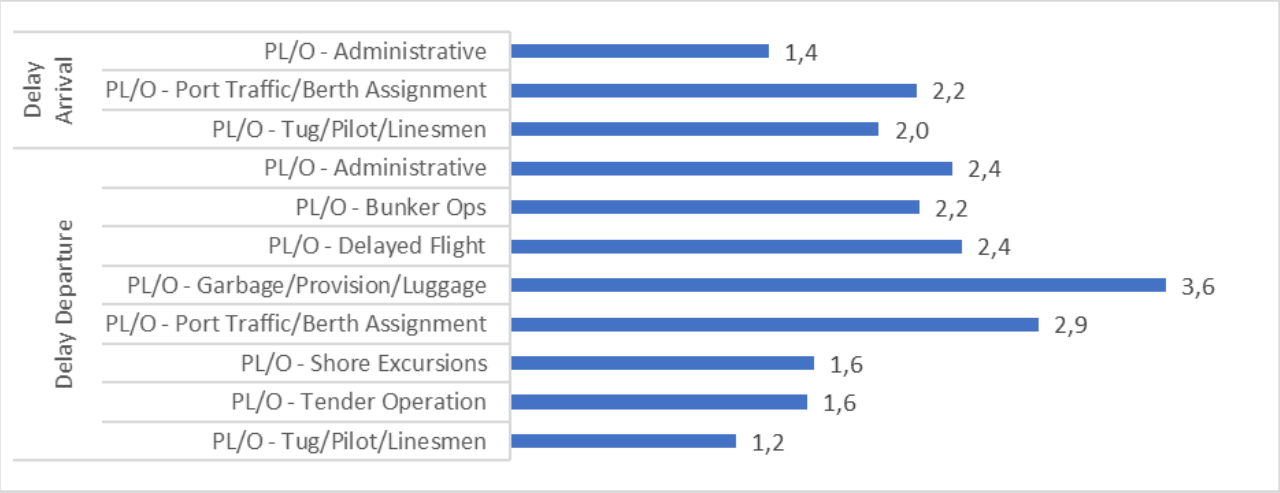


Figure 44 – average time of delay for PL/O Subcategories

Individual passengers or crew members being late were never the reason for a delay. While this could be because individual passengers or crew members are never late, it is more likely that the ship's captain usually does not decide to wait more than one hour for individuals.

7.7 Pre-Interview Information Sheet

Overview

This section aims to give the interviewee an overview of the content, aim and process of the interview.

The interview is conducted by the students Adrian Bumann and Adam Persson in the context of a master thesis at Chalmers University of Technology in Gothenburg, Sweden.
The master thesis is on the applicability of data sharing systems in the handling of cruise ship port calls, with a focus on the data sharing concept 'PortCDM' (Port Collaborative Decision Making).

PortCDM

PortCDM is part of 'STM' (Sea Traffic Management) which aims to improve efficiency in the maritime transport chain. In that context, PortCDM aims to support the port call optimization process. This is done by promoting collaboration between all actors involved in the port call, sharing the timing of future events and the combination of multiple data sources. The aim is to create improved situational awareness for all actors, enable Just-In-Time operation and therefore increase the overall efficiency. This efficiency increase would potentially result in savings of time, money and environmental impact.

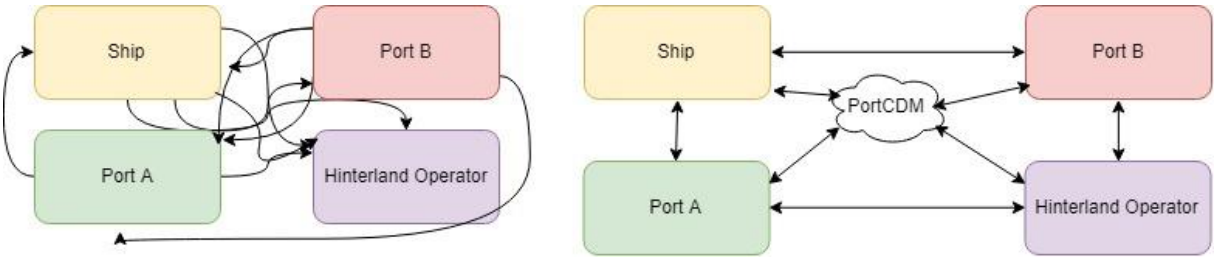


Figure 45 – structured interaction to create increased situational awareness (Lind et. al 2018)

Links for further details

STM:

- https://www.youtube.com/watch?v=JZgKnMMq1Eg

PortCDM:

- https://www.stmvalidation.eu/news/portcdm-information-sharing-in-real-time/
- https://www.youtube.com/watch?v=WX6PVeIzCvU&feature=youtu.be
- https://www.youtube.com/watch?v=ZS5SjDAol90

Interview

The interview will take between 30-60 minutes, depending on the course of the interview. The interview will be recorded by audio recorder and transcribed. The identity of the interviewee will be anonymized and the contents of the interview will be used for the master thesis.

The objectives of the interview are:

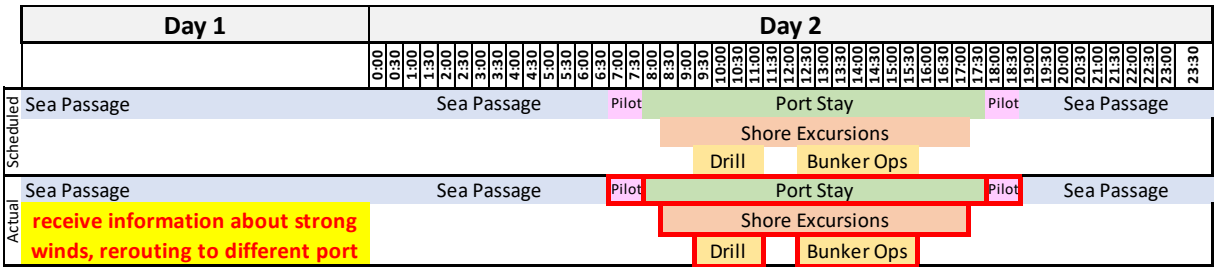
1. Role of interviewee in a cruise ship port call and possible issues
2. Opinion of interviewee on data sharing systems, specifically PortCDM
3. Verify findings of findings of quantitative data analysis conducted by students

The overall structure and topics of the interview are shown below.

Example Scenarios

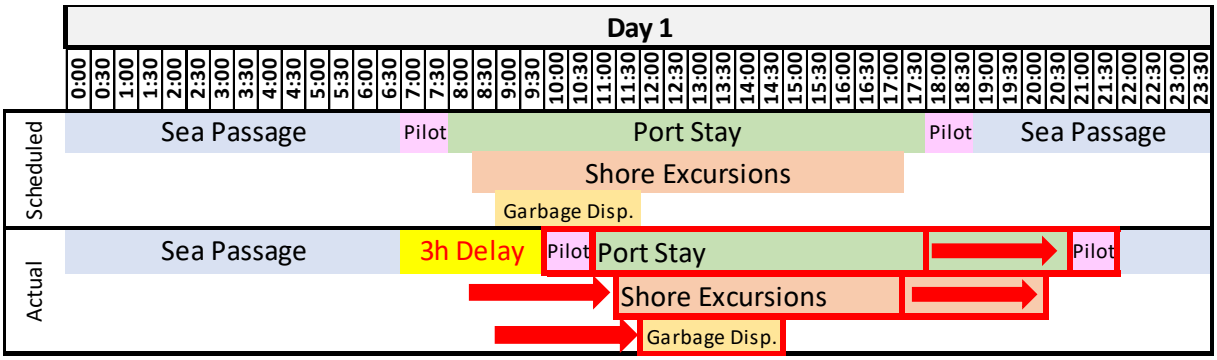
Scenario I – Rerouting of Port

- Cruise ship has to reroute because of strong winds in scheduled port.
- Services to reschedule:
  - Berth, Pilot, Linesmen, possibly tug
  - Shore Excursions
  - Safety Drill (permission for lowering of life boat)
  - Bunker Operation



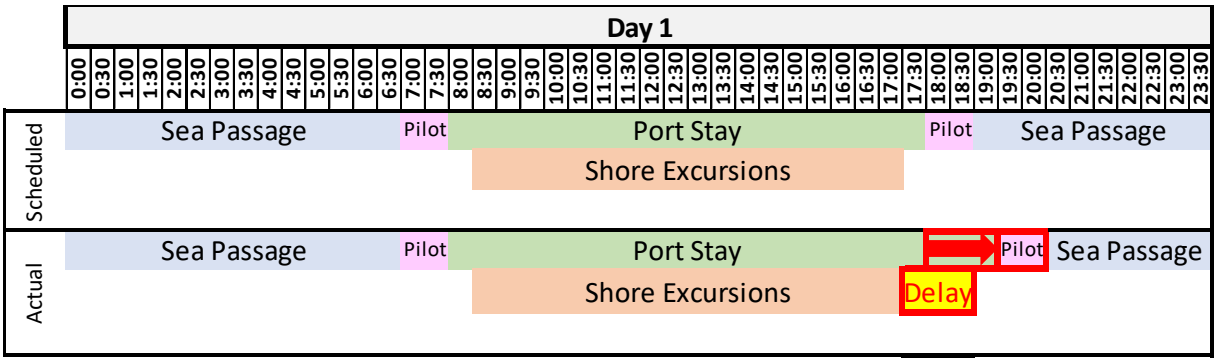
Scenario II – Delay at arrival (strong winds)

- Cruise ship arrives late by 3 hours due to strong winds. Departure postponed by 3 hours to enable shore excursions.
- Services to reschedule:
  - Berth, Pilot, Linesmen, possibly tug (new arrival & departure times)
  - Shore Excursions
  - Garbage Disposal



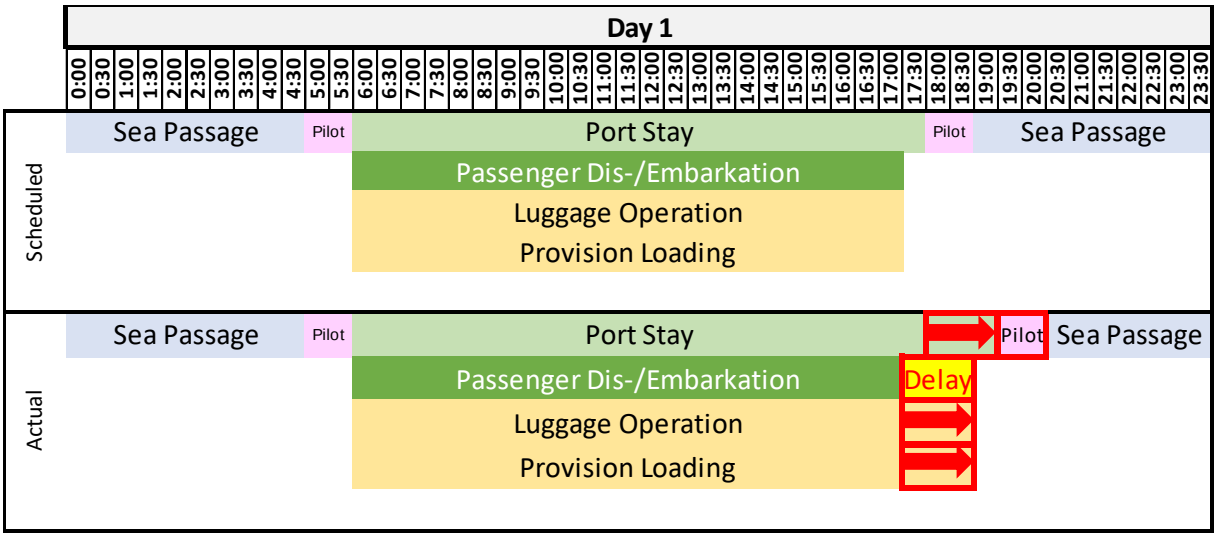
Scenario III – Delay at departure (late shore excursion)

- Cruise ship departs late by 1,5 hours due to delay of shore excursions
- Services to reschedule:
    - Berth, Pilot, Linesmen, possibly tug (new departure times)
    - Shore Excursions



IF APPLICABLE: Scenario III.I – Delay at departure (late passenger embarkation).

- Cruise ship departs late by 1,5 hours due to delay of arriving passengers
- Services to reschedule:
    - Berth, Pilot, Linesmen, possibly tug (new departure times)
    - Luggage operation
    - Provision loading



7.8 Interview Transcripts

Code	Organization	Role	Type of Interview	Subchapter id.
PR1	RISE	Researcher	Phone	7.8.1
PR2	Cyprus University of Technology	Researcher	Phone	7.8.2
PC1	Major Cruise Line	Shoreside Operation & Monitoring	Phone	7.8.3
PC2	Major Cruise Line	Director Security	Phone	7.8.4
PO1	Major Cruise Line	First Purser (formerly)	Phone	7.8.5
PO2	Major Cruise Line	Captain	Phone	7.8.6
PP1	Port A (Scandinavia)	Cruise Manager	Face-to-Face	7.8.7
PP2	Port B (Scandinavia)	IT Coordinator	Phone	7.8.8
PP3	Port C (Scandinavia)	Cruise Manager	Phone	7.8.9
PP4	Port D (Scandinavia)	Cruise Manager	Phone	7.8.10
PA1	Shipping Agency (Scandinavia)	Director (PA1a) & Operations Manager (PA1b)	Phone	7.8.11

7.8.1 Interview with PR1

INTERVIEWER: What I'm wondering first of all… We looked into your profile and your involvement with PortCDM (…). Can you maybe give us a short summary what your role in that project is? In PortCDM that is.

PR1: (…) I was assigned by (…), (…) to support (…) in the stage 1 of the STM validation project. So that is how it came to that, (…). As part of the STM validation project activity 1 we had a task to try to build in sustainability into that concept, so one of the actions that we had was to start a council to govern the port CDM concept. So we did that, and started the International STM council. We have right now 35 participant, and 32 observers. On the website www.ipcdmc.org you can find details. (…).

One thing I also try to do is wherever appropriate bring forward my knowledge from the aviation side to bring that forward to the marine side and see how marine can learn from aviation. It is a completely different industry, from functions to technical and legal perspectives. Certain aspects can marine for sure learn from aviation. Collaborative decision making is one piece. I was involved in the airportCDM and had long discussions and exchanges with Frankfurt and their mission control. That is one of the pieces that I try to pull away to the marine side as well.

INTERVIEWER: Yeah we saw that especially your involvement in aviation is quite interesting. Because we saw the airport collaborative decision making is one one side very similar to what portCDM wants to accomplish, but on the other side of course the structure and processes in aviation are quite different. What do you think are the main learning points from aviation which could be transferred to what is happening right now in the maritime industry?

PR1: Well one sticky point we have on the maritime side where we actually have difficulties to learn from aviation is data sharing. On the aviation side we have the luxury that aviation was developed in the 30s of

the last century and really came into fruition in the 50s and 60s of last century after the 2nd world war and so on and so forth. It was highly technically focused and it did not have the history which the marine has. That has pros and cons. They did not need to adapt the culture. The other aspect is that aviation was crossing borders. Aircrafts are crossing borders at a very high speed and they are actually crossing borders of coastal areas and countries where the have no intention to land. So they created a kind of data sharing where reports are done automatically, that things are planned so on and so forth, which marine has never envisioned. Well, also in aviation we started very early. Canada was first with having an authority in the 1930s, Canada air transport in 1936 I think they started. They looked into organizing aviation, centralized by the country. Then there was FAA, the civil aviation authority. ICAO was introduced and it was clear that all of those organizations needed to work together to get things going. Because you cannot anchor an aircraft, so when an aircraft is entering your airspace you need to get it through your airspace or down. You cannot way wait until we have inspected your craft, or you need to wait and anchor outside and something like that. It means that if an aircraft is coming you need to have everything organized so within a certain time period, like maximum an hour you need to get that aircraft from the targeted time to the ground otherwise they run out fuel. You need to organize that, and it only works well when you are able to share information. That was were aircraft came in and took a larger role in all of that. Automation, because the speed of aircrafts is also a lot higher than it had originally been on the marine side. So what marine needs to do now is look into how these concepts of data sharing apply to marine: where do you need to share data, where do you want to share data, and where do you not want to share data. And what effect does it have for you. The aircraft was, and I had the privilege to work with some of the pioneers who were flying aircrafts with open cockpits in the US, in the 1915, 20s and 30s, without air traffic control, without anything. They explained how that was going and how that made it safer. Starting from the 1930s the aircrafts always had connectivity with the ground, and they could not simply do what they wanted, on commercial. On the recreational side it was somewhat different, but on the commercial side they were always under control and needed to follow instructions to make sure they were safe. But until recently in marine, when a ship was leaving port it was by themselves. You know, we had the discussion about autonomy. What is autonomous? Autonomy means that something works by itself without outside influence. So in the last centuries we really actually have autonomous vessels. Which means that the crew onboard was running the ships without any input from the outside. Nobody called them, and that only opened up in the beginning of last century when we get more and more in. Captains are actually reporting details to their operation centers. That is a recent development from the last few decades that had not been there before. That means that all of that made it very difficult for people to move their baggage. We have in marine many concepts that have been developed to manage seatraffic without having connectivity. You have the agents which are doing port coordination, which is due to the fact that you didn't have connectivity, you needed to have somebody on site when you sent a letter, sent a fax or something like that. Later emails, saying this and this will happen, please organize for us and get our paperwork done, help us to make sure that the stevedores are there when we are alongside and so long and so forth. That is all changing when you start to exchange information, and PortCDM is an important aspect in that, as it is allowing to exchange data from a technical point of view with high accuracy and updating on the different timestamps to allow everyone to get more precise information on what is going on and what the situation is like.

INTERVIEWER: Yeah, situational awareness of all the actors involved.

PR1: Yep, and that has not been there before which means that we are really talking about an cultural change which is happening on the marine side. The other specific aspect was that aviation early on was forced by shippers to give them transparency about arrival times. So DHL, FedEx and others wanted to have the exact time from airlines when their goods arrive so that they can send out trucks to pick it up the parcels. DHL and FedEx now have large amounts their own aircraft to reduce costs and get better understanding and better transparency. That push for transparency I also see in the maritime side. If the shipping lines and the ports are not willing or capable besides the minimum and safety purposes. When they are not willing to share information to increase transparency to the shippers and the good owners, they will counteract.

So now wonder that Amazon now has the permission to run ships, and they will run ships if they do not get transparency from their shipping lines like maersk and others. Alibaba has purchased their first few ports.

INTERVIEWER: Yeah, it is an interesting development. It is a step towards a more holistic intermodal transport system basically.

PR1: Correct. Correct. And another aspect I will bring to your attention is one I recently discussed with Hamburg. The cities which have ports have same as other cities, environmental issues. They have issues with SOx, NOx and COx and other environmental damage and emissions, so they have to actually do something to improve their conditions. One of the issues which ports pose to cities, and especially when you have city ports like in Bremerhaven, Hamburg and even Rotterdam is that you receive a large amount of pollution from trucks that are coming into port to leave or pick up containers and other goods. We have started to have a testbed in (port) to have the connected port to the connected city, to have smart traffic light. If you know you have a ship coming into port which will carry, say 3000-5000 containers the traffic lights will let the trucks through so that they won't need to stop too often when going into the port and pollute the city at all individual red lights. So this connectivity will be simply expected from ports, and ports can no longer simply ignore that and not connect themselves to boost transparency.

INTERVIEWER: I have a friend who lives in (port), close to the port. She told me that when the wind is coming from a bad direction you can really smell the port. So such a connectivity would be a huge advantage to the overall city planning and living quality.

Adam: Actually, interestingly one point in the port of gothenburg the owner's directive of the port, it's owned by the municipality, is that the port should reduce the amount of heavy vehicles trafficking through the city. That has been moved from the national transport administration to the port. Which is a rather strange directive that has been passed along to us since nobody could find a good solution. So it is now on our table as a port authority, to decrease the amount of trucks going through the city. Which we try to do mostly through the use of railroads in our development plans.

PR1: Right.

INTERVIEWER: Talking about these connectivity systems, in Hamburg it is a quite specific system for that city, then we also saw your your involvement in the PRONTO system being implemented in the port of Rotterdam. Again, that is mostly a closed internal system for the port itself. Fraunhofer have developed Vestvind and the real ETA project, so there are a lot of projects developed of how to utilize information sharing. Where do you see PortCDM in relation to these other systems?

PR1: Okey, so PRONTO and the DAKOSY systems just to name two, are Port Community Systems. So they are developed to help the ports organize their work. To ensure that the ports run successfully. They are not necessarily interested, or they are very port-centric, or maritime transport centric. So the main aim of DAKOSY or for instance PRONTO is to enable the port and the port actors to be as efficient as possible. In fact, one of the special conditions I saw in Rotterdam is that they have a very strong harbour authority which is responsible for quite a few things which other harbours don't have, so it is a bit more centralized than you have it in other ports. The thing I will say, for example when we talked about S-211 with the Rotterdam harbour master. He said you talk about recommended time of arrivals, we don't have that, we have requested time of arrivals. We tell the ship when they come, and that is when they have to be there. So that is a different mindset for going forward, but it's also quite the same. Those systems are more port-centric, but they have to be, since they are specific to a given port. That is the reason why I haven't seen a PRONTo system for example to be dispatched in another port, because each port is different. In PortCDM we are not defining how a port is to be run. We are not defining how PortCDM is to be implemented in a specific port, because it will be different between ports. What we are saying is that PortCDM is a certain concept and if you tell somebody that you are implementing PortCDM that person from the outside has an understanding what it means. I will give you an example again from airportCDM. Frankfurt airport has a

certain implementation of airportCDM, that is due to the fact to how the collaboration is in the airport between German airport control, DFS, the airport authority that is managing the airport, the customs, the border control, the catering companies and so on and so forth. That is how it is set up. That differs from other airport. What eurocontrol developers of airportCDM said is that if you are to be an airportCDM compliant airport you have to do the following things. We did the same with portCDM. We developed it in the project and the validation phase, and refined it in the IPCDMC, the concepts of maturity levels. So you can have different levels of portCDM maturity. It doesn't mean that if you are on a lower level of portCDM maturity, for instance level 1 or 2, that you are less optimal so to speak. Because it could be that a higher maturity level is just overkill for you. If you are a port of..

INTERVIEWER: A small port like Warnemûnde..

PR1: 2 ships a week, you do not need a port community system, but you need to get your people into the port so the ship is not waiting until for example linesmen are coming. So there need to be something done, and the overarching is done on a global level with the International Port CDM council, and the expectation is that we have one governance level, and a next level which is a regional and cluster level. Where you can say for example that Europe defines a certain aspect. European single window may have an effect on how PortCDM is to be run, and we are right now in discussions with a couple of countries on the national single windows, and their potential link into portCDM. They are different and will be different to for example what USA and Canada does. The ports in Chile for example are very centralized as they are under the auspice of the navy, so there is another communication chain to what you will do in that respect to what you would do in some ports in Belgium which are very decentralized. So when you take a look at portCDM, portCDM is not an implementation, portCDM is setting the technical standards and the technical specifications so that different systems can actually exchange information fluently, so that systems like PRONTO can receive data from any and all ships which are coming into Rotterdam and not only the likes of Maersk which have a direct relationship with Rotterdam. And that Rotterdam and Hamburg can exchange the data, and not like right now in a very rudimentary way but in a standardized way and the communication standard. The communication standards will be the same when Rotterdam is communicating with Hamburg as when Houston is communicating with Richmond in the USA. So that is what we said on the technical side, and then we set rules on the operational side, that PortCDM means the following compliance criteria which we have developed in a draft and are currently discussing in a working group in the IPCDMC.

INTERVIEWER: Okey, so if I understand it right, the technical standard, the S-211, the maturity framework and also the governance of the council would enable predictability and a certain standard understanding from all actors when they want to utilize the PortCDM, would that be correct?

PR1: Yeah, more or less. It is building the basis, the foundation to enable, that's correct.

INTERVIEWER: We talked with some ports before, specifically Stockholm was one port which said that they are very content with their internal port community system. What would you say would be an argument for such a port to adopt PortCDM as an additional standard?

PR1: As I said before, PortCDM is not defining how a port is to be run. As I also said before there is a push in the industry right now for data sharing. That push is not port internal, that comes from the outside world. There is a need for optimization, yes, but the real push comes from the outside, from the shipping lines. Each shipping line has their own just in time logistic program and so on and so forth. But if Stockholm is saying we have our system, we like our system, it's running correctly, that is no problem. Then we don't have an issue. If they want to look into potential benefits of PortCDM. For example for a simple API, an interface to be able to ingest and send s-211 data, that would mean they are already level 1 compliant. If they have the internal systems, and the internal systems allows them to share information with the actors, which they already have. When they have an internal ingest, reach maturity level 3. Then they can say okey, what else can we learn from this concept and apply it here. When Stockholm is talking to Rotterdam, Valencia and Hamburg etc they can say yes we are PortCDM compliant, we can receive and send the

information. Rotterdam has their PRONTO system, Hamburg has their DAKOSY system, they agreed to exchange information because they simply have to, otherwise they cannot operate efficiently, so they agree to do that, but they do not change their systems. Hamburg won't implement the PRONTO system, and Rotterdam will not build on top of DAKOSY. They will exchange information, and S-211 would an international standard. We are right now talking to them, and DAKOSY is implementing an S-211 data stream. They can use it for all kinds of area. They are not building something just to comply with Rotterdam, then need to build another connector from Bremerhaven, then another connector for Barcelona, then another for London. They build one connector, s-211, they get s-211 data streams and can automatically connect. That is the whole idea behind the IMO e-navigation concept. You have a common maritime data structure, PCMF, which allows the interchange of information. The other aspect which is to be mentioned, if you build an island yourself, if Stockholm has their island, that is good and fine. But when you for example look at the logistic chain, logistics is using other standards, with for instance GS1 being one standard. Now, you need to somehow connect the information on port arrivals with the logistic standards used in the logistical industry, the trucking industry, the train industry, the goods owners and the shippers. The technical basis for PortCDM, S-211 is compliant with the common maritime data structure and it includes MRN, Maritime resource naming. GS1 is in the process of also implementing maritime resource naming, which means you can interlink those data streams and then correct for data analysis, all things there. If you have a standalone system that is not complying with all those standards, you need to do all the translation yourself, which in the end has proven in all other industries to be detriment.

INTERVIEWER: Another thing we were wondering about is that a lot of the focus of PortCDM is on cargo shipping, and I absolutely agree that there is a need for optimization and that there are a lot of inefficiencies, and for this aspect PortCDM can be hugely beneficial. We are looking specifically on the cruise side. In the standards and in the operational and the legal standards, do you differentiate by shipping types? Do you have certain procedures for certain ship types, like container vessels, tanker ships and passenger ships?

PR1: Not at this time. What we are starting to look into is classifying ports, and see if there is a need and a benefit to classify ports as specific ports of a certain type. We have discussed this in our team, but we haven't made up our mind yet. If you go to our concept notes, and I assume you have read them. One concept note is specifically looking into the passenger ships..

INTERVIEWER: Yeah, I think it is number ten.

PR1: Yeah, so passenger travel has not only in the maritime side, but also in other arenas, very specific and special demands. Whether if you go by train, or by ship or by airplane it has special demands. I will give you another example outside of our maritime domain, of aviation. It is a no-no in aviation to divert an aircraft that is a passenger airplane because your paid clients will not be happy when they want to travel to London and they end up in Paris, they miss their meetings and so on and so forth. With cargo however you could potentially do that, because it could be picked up by a truck. We have similar situations on the maritime side. A cargo may be late, but a passenger or cruise ship cannot be late. If I am a passenger on a cruise ship on the Mediterranean going to Palermo, I want to be there in the morning to have a full day in Palermo, and I do not want to end up angry outside in the Mediterranean and come in at lunchtime. There is a clear demand. On the other side, you have different aspects to influence that, so that it is as precise as possible and not negatively influencing other aspects. So you also need to be sure that when you are coming alongside with your cruise ship that your buses are there on time. You do not want them to stand there for hours until you come in and you do not want them to stay longer then they need to stay, so you also have the need for those engagements. Or for example, the last time I was onboard a cruise ship I was on the bridge and talking with the Captain which was quite interesting. It was Costa Diadema so 6000- some passengers, gigantic ship. When we anchored in, I think it was Marseille, but I'm not quite sure, I saw in the morning people coming in to clean the inside of all the windows in the inner side of the ship where you have the open arena. They used ropes from the ceilings hanging down 4-5-6-7-8 stories. They are not cleaning while people are onboard, so they need to come in when the ship is coming and be done before the ship is leaving. So they need to know when the ship is coming and when the passengers leave so that they can come in

before disrupting the passengers, and they need to know when the need to be done and leave before the passengers get back again so they are not disrupting them. It needs to be organized somehow as well. That is where transparency and predictability of actual time of arrivals, estimated time of arrivals are important. For cruise ships it can actually be a lot more important to have the minutes right then in containers or bulk, but it is the same concept. But if you have a cruise ship which is coming into Hamburg you need to come in with the tide, and if you miss that you need to anchor for 6 hours which means you will miss that port, so that means you need to actually know how that shifting of the tides together with your arrival times needs to be handled. So that is another aspect we think might be interesting. At the moment we don't have specific guidelines or procedures or something like that because we are still working on a very high level. We are working on the first iteration. We are trying to help the maritime industry to understand that data-sharing is important, to get the facilities there so that they can share data, whether somebody is a new ship, approaching a new port, or a a first-time port or a port which receives a ship for the first time from a certain shipping line, or somebody who is coming as a tender vessel or ferry continuously. So we are at a high level at the moment at the moment, and not at the detailed level you would have if you are segregating between those different ship types and so on and so forth.

INTERVIEWER: Could you imagine that in the future, let's say we are 10 years in the future. Do you think that might happen at one point, to have such a specialization? You mentioned the cleaners at one point, and to have such detailed parties and such small parties in the data-sharing environment.

PR1: Well absolutely. And when we take a lot at the interest that we actually receive about PortCDM. It is sometimes going out of areas you could never dream of. To give you one example I am very active at LinkedIn and I have about (…) followers, so I need to be selective when people say I want to connect with you. So I got a request from somebody from Dolce & Gabbana, and I said I don't know what that means, because I'm not a fashion guy and my wife is neither, so I have nothing to do with Dolce & Gabbana. I asked that lady why she wanted to connect with me, what do you want? What do you see as a benefit? She said she works for a fashion company and that we do have issues with shipping. We are preparing new collections and we have the presentations of new collections in special places like let's say Tokyo. The day after the day after our clients in London and other places wants to buy the stuff the see in the TV in the store in London. Which means we need to organize in a way that we can only have a presentation on the new collection when the collection is already in the stores. We need to organize those types of events that takes weeks, because we need to have TV stations there, and you need to have the location reserved and you need to have the models there and so on and so forth. We can only get to that exact date when we know for sure that the ship will arrive, so either we are scheduling that when we have the goods already in place for 3-4-5-6 weeks until we have the presentation, or we are risking that they are not there when we present them in Tokyo. If we have high precision, more reliability when our collection is arriving in for example Southampton, we can estimate very precisely how long it takes for our truck from Southampton to London, how long it takes to get it into the warehouse, to get it into the store so that people can buy it. But we have no ideas when the ship is coming. So their interest is in transparency so that they can organize as early as possible, their fashion weeks. That is something I never envisioned, that Dolce & Gabbana is interested in PortCDM. Because they don't have ships, they don't have ports, they are not a shipper. They give it to DHL or someone else to handle it, but they want that transparency. That is what is necessary in today's world.

Adam: That is really interesting.

INTERVIEWER: Yeah, that is a really interesting aspect, that the customer takes an interest in the logistics, and I don't think I can think of examples where it happens to to that regard. But I can definitely see the benefit for that.

PR1: I'll give you an example from outside so that you see that it is happening in other areas as well. I have a friend and he bought a Porsche. I don't have a Porsche, that is too expensive for me, but that is beside the point. So he has a Porsche, and he was actually going to the factory to pick up his Porsche. The logistics in Porsche is different then what you have in other car factories. Usually you have a production line, and

the production line is for one model. So you have a production line for VW golf or you have a production line for Mercedes C-class or something like that. Porsche has all their different models in one production line. So you have on the line a cayenne, the next one is a Carrera, a Cayman and so on and so forth. All of those cars have different windshields, of course the design is different, the windshield is different. The supplier for Porsche which provides the windshields, needs to provide the windshields in a just in time manner, what that means is that they are coming with a semi-truck, with I don't know how many hundreds of windshields. They are on the truck, and the truck is actually driving onto the production line and they are are picking the windshields directly from the truck and putting them on the cars. Which also means that the windshield factory needs to put the windshields on that truck in the same order as the cars produced on the production line of Porsche. Which means that Porsche needs to connect with that supplier and tell them when exactly, which car, with which windshield will be on the production line so that is it mounted correctly on that suppliers' truck to fit the Porsches on the line. So here you see how just in time logistics of suppliers is fully integrated to be able to gain those specific aspects, for instance that Porsche doesn't need to have any storage anymore, they do not need to unload and reload, they simply pick it up and put it in, that's it. In maritime we are far away from that, but we are starting to go towards that.

INTERVIEWER: Yeah, once you have a system setup, if you the structures and processes in place, then you can enable all these savings like removing the storage unit for the windshields for instance.

PR1: Yeah, right. But the problem we have in maritime is in the example of Porsche they have a limited amount of suppliers, and if a new supplier comes in they can set up those communications and things and test them and so on and so forth. For a port it is not possible, because they might get a call from a ship that comes out of Panama, and they have no possibility to build that connectivity portal so to speak, because it's on demand and more flexible. So that's why we from IPCDMC think that PortCDM as a concept and the international standardization, not proprietary data streams are key to be successful, both for ports as well as for the shipping industry as such.

INTERVIEWER: Mhm, okey. Just one think also to clarify. If you look at these processes do you look at individual actors in the ports like the shipping agents, or would that already be on a too-detailed scale?

PR1: No actually I had the discussion with a couple of ports when we started the potential implementations. The point is that the PortCDM and the data exchange will not eliminate the agents for example, but it will change how agents will behave. The workload and the tasks of agents will change. So we have here the same thing as we have in other industries, that those which are in a specific niche, needs to see how they need to change in order to adopt their business model to new demand. If they don't do that, yes they will disappear, but if they do that, they actually may have a better business model. So an agent who is able to electronically digest information, he doesn't need to have people he doesn't need to have people to type in the information, then handing it off, that will be done automatically. They can streamline what they will do, and provide better services to their clients. Uhm, if they don't do that, the clients will simply disappear, because they will go somewhere else or simply do it directly.

INTERVIEWER: So basically you are saying that adopting these technical opportunities will also bring economical advantage?

PR1: Absolutely, absolutely. It absolutely does for the port ecosystem. It absolutely does for the shipping lines and the shippers and so on and so forth. For some it may not be an economical advantage or a primary economic advantage, but if you can quantify it it, it may be a knowledge advantage like transparency which will help you to streamline in completely different areas what you're doing. But for the ecosystem, definitely it's improving, and you can see in the results of the test beds that we have in the STM validation project. But it may be different from actor to actor. So you may have actors who are refusing which reflect flexibility. To give you an example the discussions we have with terminals who say that we have right now contracts, and those contracts have slack time, and we want to keep those slack times because that gives us the flexibility to arrange our internal processes for our purposes and the client is so happy with that because it's

within the contract. But what they need to understand is that the client is not happy with that, he accepts it because he doesn't have any additional option. But no shipping line is happy that the ship is sitting idle at a berth place, because the cranes are not yet there or the stevedores are not yet there or something like that. Even if that is within the slack time in the contract which they have with the terminal. So as information increases, the pressure of optimization is increasing. The customer will simply demand that they have less slack time. That they have a better understanding of it, and if it can be faster then they may disappear faster and go to the next port. So you may have somebody who thinks they are losing our ultimately as long as they didn't gain the benefits of as for example take a look to pilots. If you have a pilot organization which is more or less busy and maxed out, and have the tendency to let a ship wait at the pilot boarding position until the pilots are there, and the pilots are always occupied and never sit around idle that they earn their money and everything is fine. Why should they coordinate better? Since ships cannot get into the port without a pilot, it doesn't help them too much. Well, if they really think about it they may be able to serve more ships when they organize better, when they have more information. But that is something which will be in discussions with the individual agencies. Overall I am hundred percent that we have seen evidence, not only in our testbed but also in other areas that the port ecosystem and the shipping ecosystem enlarge definitely is economically benefiting.

INTERVIEWER: Yeah I can absolutely see that. What is interesting is that in our thesis we have also analyzed a quite large set of port calls for cruise ships, and compared, let's say the performance to those of cargo ships. We found that, it's not completely finished yet, but it seems that cruise ships are much more scheduled and precise in their operation. We saw some statistics about inefficiencies of cargo ships and the cruise ships from all data only in 5% of port calls have a schedule deviation of more than one hour. So that's one aspect that we're looking at, what benefit data sharing systems and PortCDM specifically can bring for cruise companies, which are first of all very often on time, and almost all big players. The cruise industry is more oligopolistic than the cargo shipping industry, so you have for example Royal Caribbean, you have Norwegian and you have Carnival. All of them have operation centers and quite advanced internal communication systems, so that's one of our research questions, what can they benefit from such as data sharing system?

PR1: So.. I will try, but if you analyze it you will see, as you most likely already have seen that there are big differences in operation between cruise lines and cargo operations, and that is that cruise already has a lot of connectivity. They are organizing a large part of what we call PortCDM, it's done by them anyhow. Because they simply need it. The pressure on them to do that was always very high but not on the cargo side. So they started inventing ship operation centers. It's because they needed that communication and that connectivity, and as a result they are much more precise. So I would see it differently, the other way around., The fact that they have a much higher precision on arrival time is true to the fact to that they have organized themselves around the major paradigm of being precise, because that's what they have to be, period. Where on cargo side it's more on, and was for a long time on a.. cheap travel, or cheap transport, so savings for the ship lines. If they come late, they come late. If it makes them cheaper, it makes them cheaper. Whatever was the main aspect, the main KPI, or the KPIs were different. But on the other side they are also working on islands as to say that they are very monopolistic, and they have a great power, if they are coming in late. On the other side I was just in Funchal on vacation on Madeira and we had on one day three big cruise ships there. So we have the Mein Schiff 2, one of the Aida, I forgot which one it was, and a third one, a smaller one with 2500 people out there. So, you have more or less 10-12 thousand people which are coming into that port.

INTERVIEWER: Into that tiny port.

PR1: Into that tiny port of Funchal. And these are bored people which are living at the center of Funchal (???), so they need to do something, they need to get out, so that's a high pressure on the port, to serve that. If the communication between the ships and the ports with PortCDM allows a better utilization of those assets, which the port has available, which is limited, they could potentially serve a fourth ship. If they are for example not coming at the same time, with one coming in the morning, the other like three

hours later, something like that. That needs some coordination. And that needs coordination, not only between one operation center, so it's not only about the coordination and communication which TUI has with Mein Schiff, but it's also between the different competitors which are calling the same port. Same is true in Venice for example, when it's 2-3-4-5 cruise ships out there in the cruise terminals, then 50% of the people in Venice are cruise ship passengers. When you are staying in Venice you see in the evening at 5-6 o'clock the city gets empty when the people leave for their cruise ships. So I think there are aspects which needs further analysis, but we can keep that in mind I think that the research theme of your research, which is quite interesting on the comparing of the precisions of arrival times of cruise ships and non-cruise ships, cargo ships for example, is a good indication what effects more coordination, more data sharing could have to the transport chain as such.

INTERVIEWER: Yeah, and it's kind of a repetition question as we talked before about what ports having their own internal system, if you would talk to a cruise company which has an advanced internal system, what would you say to convince them to use PortCDM?

PR1: Same, same as I said before with the ports. Your internal systems are built up and geared up for organization and your own internal environment, you are not an island. Even Carnival cruises or MSC cruises are not islands. They are not isolated. They are working in ports and they may or may not be happy with the handling of the port because most of the ports are mixed, so you have cruise terminals but you also have cargo terminals, you have other vessels going back and forth, work boats and so on and so forth. When you are connecting yourself with PortCDM, the PortCDM ports can provide you with much more accurate estimated, requested or suggested time of arrival. Real time of arrival, which allows you to better plan your passages. And quite frankly when it gets even more interesting is when you are running into trouble anyhow. If you have a major storm, and you have to think it's out order. If you have a major storm in Funchal for example you may not be able to enter the port of Funchal at a certain time, you need to wait until the storm is gone. But then you do not know do I have the facilities there? What does it mean if takes another hour or two hours? What if I potentially can go into Funchal two hours early, steaming ahead getting there early to be in the port when the storm is coming, then the people are in the port on the ship but cannot leave. Because you don't have buses you have nothing there. Especially for cases where it's out of the ordinary. It is when a PortCDM connectivity with the cruise lines could be very beneficial.

INTERVIEWER: That is a really good point. Actually, that is also a point we have looked into and a point that was mentioned a few times in other conversations which we've had with ports. Personally, I absolutely agree. We can talk about some preliminary results from our results as well. We found three occurrences which would have a high potential for such a data sharing system. That's either events which can be avoided completely, or where the impact can be reduced. That would be short term re-routings. For example, a ship is going to Funchal and one day before they get a message that there is a storm and we have to find a replacement port on a very short-term basis. So then you have to coordinate a lot of different actors. The port actors, onboard, the people in the shore operations center. A second even is when the ship is coming late into the port, let's say one hour later, so the shore excursions start one hour later and so on, maybe the departure would be late as well. A third event would be when the ship is delayed by third party involvement, so parties which are not belonging to the port or the ship, again for example shore excursions late or in case of Hamburg and Mallorca the passengers coming with the airplane late. So these were the three main example where we saw that they happen firstly more often than other events, and secondly they have a potential for a system such as PortCDM and where it would not be enough to have an internal system but actually the real-time information sharing between all the actors.

PR1: Mhm, mhm. Yep.

INTERVIEWER: (..) Thank you for the interview!

7.8.2 Interview with PR2

(Brief introduction of ourselves and our master thesis project topic)

INTERVIEWER: Can you briefly tell us about your role in the STEAM project and the port of Limassol?

PR2: Basically, I am the project coordinator. The Cyprus University of Technology is coordinating the whole project. The other partners that are involved are Cyprus Ports Authority, Cyprus Shipping Association, which is the agents basically. They are represented by the association. Then we have from the private sector Tototheo Maritime and we have Delevant who are doing data analytics basically. We also have Cyprus Subseas who are mainly working with environmental monitoring systems and with those gliders if you are familiar with those that go underneath the sea and collect measurements, so that's their expertise. So basically, what we want to do is turn the port of Limassol into a smart port and apply new technologies. We already have PortCDM implemented through the previous project, the STM validation, but now we want to enhance it even more with port to port communication nearby ports in the Mediterranean area and the other ports on Cyprus. Basically try to get as many people involved as possible with what we already have, and add to this the environmental monitoring, the data analytics and enhance the whole PortCDM to turn the port of Limassol into a hub area both for short sea shipping operations and a hub in the Mediterranean sea. So that's the main… the project in a nutshell, the main idea.

INTERVIEWER: What other technologies are you using, you mentioned PortCDM would be one of them?

PR2: Right. PortCDM is one of the components, the other one has to do with establishing a shore centre at the Limassol port, were we have the capacity to communicate with the ships. This could also be achieved through PortCDM, but we have it as a separate thing currently, where we provide information to ships in the area. I mean the shore centre idea we brought from where the previous project ended, the STM validation. The third component has to do with environmental monitoring technologies and the other new technologies, so we are thinking here about buoys that are collecting weather information, and current information, pollution information. Maybe by use of drones to collect environmental information relating to the port. Another component is the data analytics where we will collect all the data from the different systems and integrate it together in one common platform, database, where we have a chance to investigate for maybe relationships between the data, maybe devise some new business solutions for the local users. So that has to do with data analytics, data mining and data interpretation and building new applications and new business solutions based on this. These are the different dimensions. The idea is to keep having living labs which is something we borrow again from the previous project, with all the stakeholders involved communicating with each other and collaborating and all that.

INTERVIEWER: Okey. You mentioned the data analytics, Could you give an example of some possible new business collaborations or new insights you can imagine getting from the data you get?

PR2: Well one thing would be to combine pollution information with for example inside the anchorage area with particular ships so we will be able to identify if ships are polluting the area of the port or the anchorage area. That would be one use. Another use would be to utilize information from the current, to try to tell where the ship is heading and track the ship based on the current information. There is research going on about this right now from one of our partners. Another way to use the data is to optimize things like berth scheduling for example, or the way the ships arrive at the port, to optimize that. Also the container handling inside the port. That's one thing I forgot to mention; we also have advanced tracking. For short-sea shipping it is important to know where each container is loaded and unloaded so you can be fast with the turnaround process. That's another area we would like to… I mean those are just some examples, but it depends on what we find throughout the project, through the living labs basically. Through the interaction of the local stakeholders. The idea is to build something that will benefit their operations and improve their efficiency.

INTERVIEWER: It is very interesting. How is the feedback so far from the involved actors?

PR2: Well we were lucky enough to build some good relationships with local stakeholders through the STM project. I was the business coordinator for that project. We were able to establish, and you know that the port of Limassol actually went through a privatization process through the lifecycle of the STM project, so it changed hands from the government to the private stakeholders. We were able to go and meet with them, and they are all onboard now. All the local stakeholders, the important ones that are involved in the port call process are also part of the project, as are the associated stakeholders. So we have good relationships, and they are very responsive. On the other hand if you tell them to do something, they will say they are very busy right now, leave it for later. These days they come to the meetings, and they respond when we call them.

INTERVIEWER: So they are generally willing to collaborate?

PR2: Yes, they are very willing to collaborate, and they are very interested with what we are doing with PortCDM. So a very positive reaction.

INTERVIEWER: Are these stakeholders the typical port actors, lets say the ports and the shippers and the warehouses, or is it also outside?

PR2: We have the Port Authority, who are basically the landlord of the port, and they are also responsible for some environmental and security issues, and they also have the Port Community System, where they collect information. So they have IT, they have the VTS operations, so that's part of the Port Authority. Then we have the private companies. We have Eurogate which is a container terminal, DP World which is handling the cruise and general cargo terminal. Then we have P&O maritime which are handling all services relating to pilots, tugboats and linesmen for everybody. Pretty much that covers the important stakeholders involved in the port call process in the port of Limassol.

INTERVIEWER: We had a conversation last week with another port, and they mentioned that they are looking into their processes with the municipality, for example if there is construction work ongoing, they connect the information with the port, so that the cruise excursions, transportation companies for cargo and cruise passenger excursion can adapt their schedules. So the idea would be to integrate the port and the port logistics to the whole municipality smart city.

PR2: Interesting!

INTERVIEWER: How is your perspective on that?

PR2: I think that is a really good idea. The idea of connecting to the hinterlands is already a part of the PortCDM maturity process, so at a certain step we are hoping to interact with everybody on the outside as well that are involved in this process. So everybody related to this would benefit from having this information. That's a very good example, what you just said.

INTERVIEWER: I saw that you are employed at the university, and not at the port…

PR2: Right. So I am an academic, an assistant professor. I should have started there basically! *laughter*

INTERVIEWER: Perfectly allright!

PR2: So yeah I am supposed to teach and do research in the area of telecommunications mostly, so I am in the electrical engineering and computer science department. I teach mostly classes in communication systems, digital communication, wireless communications and so on. My research topics are more within the fields of smart systems, Internet of Things technologies, wireless sensor networks and so forth.

PR2: (Informal discussion about involvement in STEAM project, ~18:00)

INTERVIEWER: When you were talking with the involved stakeholders, did you get any information what their motivation and expectations were? What problems they hope to solve with the STM and the STEAM projects?

PR2: Well one of the big problems they have is with wrong information and not having real time information on what is going on, mostly relating to ETAs for example. Those were not correctly entered or sometimes missing completely from the system. So that was one big motivation for them to start using PortCDM basically. The other thing they really wanted is to have communication from nearby ports. That they insisted on from the very beginning. The situation with Cyprus is pretty unique, because the nearby ports are very close, so it is sometimes not enough for a shipping agent to enter the information because it only takes 8h to go from Haifa to the port of Limassol for example, so it is better to get the information from the port directly instead. A big thing for them have to do with having accuracy and real time information with the calls so that they can do better planning. The terminals wanted information ahead of time so that they could plan their resources ahead of time and allocate the berths and everything. This I would say is the primary reason for joining.

INTERVIEWER: Sounds plausible. I've been in Limassol myself with the cruise ships, so I can imagine it being Haifa, Antalaya, Port Said being your main surrounding ports.

PR2: Exactly.

INTERVIEWER: Have you heard any previous issues from DP world, the cruise terminal perspective. Any problems they frequently had and wanted to solve with STEAM?

PR2: No I don't have anything that is cruise specific to report. They created a new terminal for the cruises, and I think they don't have enough traffic yet. None of the comments were specific to the cruise calls as such.

INTERVIEWER: Okey. You mentioned before the different data systems. How to you bring them together? Do you have one common platform for this, or different platforms?

PR2: The idea with STEAM is to have one common platform to integrate all the information, so we consider PortCDM as one of those systems so to speak. Actually, it's not a system.

INTERVIEWER: Yeah, it's a concept!

PR2: Yeah exactly. We treat it as a system that has the port related data so to speak. We also integrate environmental information and the information coming form the AIS, and other sources as well. Maybe tracking information from sensors inside the port. Basically, all the information is planned to be integrated into one platform that is to be housed at the university for the project cycle.

INTERVIEWER: We talked with some ports that haven't really heard about PortCDM or newer technologies that are available. Their concerns are that it would involve too much effort to build a new system, and that it would only work if t could replace existing system. You know answers like it would just be one more password to remember and one more login to handle, it will be more work than effort. What would you say to those people?

PR2: That basically PortCDM is not another system, that it is basically a way to have a common platform to interact and exchange real-time information that is going on. So basically all of their systems would be used, and all they would have to do is build a connector to receive information in the port call message format. That's all they have to do basically. Of course it would need someone to support the integration of the platform, the relation of all the information together. That could be any of the local stakeholders at the port, or an outside company or a university. It could really be anybody that does the integration. It is

not another platform, so the idea is not to sell another system, but to sell the concept of having real time information exchange and awareness. That's what I would say to them

INTERVIEWER: It sounds good. I can imagine that when you have your platform with all the environmental information and the data you collect, it's easier to have one platform to bring it all together instead of integrating that information to the existing Port Community Systems.

PR2: Since we are talking about other types of data, it is not clear how this would be used. We think PortCDM for example, this is why we want everything integrated into one platform so we can do the data analytics afterwards. Also to combine different types of data together, or you know, investigate relationships. It's easier if you have it in one common platform. Also to apply any cleaning or validation you need.

INTERVIEWER: How was it done before? Did the port collect this type of information before? Especially talking about measuring the performance and historical data.

PR2: They were not doing it before. They had an old Port Community System that they replaced with a new Port Community System. They are not collecting enough information to be able to do this. They don't have information coming from the terminals for example. Even the P&O Maritime services. All of this information is missing from the PCS. So in terms of measuring and tracking KPIs, I don't think they are in a position to do this right now.

INTERVIEWER: Yeah. It sounds…

PR2: …They don't have the data to do this right now. Unless they collect it manually.

INTERVIEWER: …I can imagine they're not very keen on that heavy workload. It pretty much mirrors what we've heard from other actors. (Introduction to quantitative thesis analysis and findings).

PR2: Maybe we should integrate the planes as well for the cruises!

INTERVIEWER: (Further discussion about data sharing efficiency in cruise calls compared to cargo shipping)

PR2: Yes, cruise calls are prioritized as well. We did analysis of the last two years in the Port of Limassol. The cruise calls were always the most efficient, arriving just in time without any waiting times reported compared to the other types. But we don't have the analysis of what goes on after, or third party involvement.

INTERVIEWER: How was the efficiency for the other types of ships?

PR2: It was significantly less. I mean they had waiting times. So could be justified based on the type of call that they were doing. Some were tanker ships that could be refuelling etc. But we don't have the detailed data, but rather just recorded this data from the PCS system. So we only have the time they arrive at the traffic area, and the time they berth. We don't have any data of what happens in between. This data we hope to get from PortCDM when it's fully implemented. We're missing the important things that go on during that time.

INTERVIEWER: Do you have data on how long they planned to stay in port?

PR2: We have the departure times so we know how long they stayed at berth.

INTERVIEWER: Did they give any indication before, like we will come at 8 and leave at 4, but then they leave at 10 so they have a delay.

PR2: Yeah we have the estimates from arrivals and departures as well so we can calculate some kind of punctuality. That's what we did in a paper we recently had published in the sustainability journal with

(Swedish informatic researcher). We produced some punctuality analytics for different calls, and also by port of origin because we thought that might be influential as well. We also did an analysis of shipping agents, which showed some very interesting results.

INTERVIEWER: Oh yeah…

PR2: So that showed the greater variability of all. So it seems like the shipping agent plays an important factor in all of this.

INTERVIEWER: That's really interesting, and something we heard a lot of our interviews.

7.8.3 Interview with PC1

INTERVIEWER: Could you briefly describe Your role and your involvement and cruise ship port calls?

PC1: I am working as a operations manager. We are the first point of contact in any case of if something unplanned is happening problems regarding weather conditions Medical disembarkation call to the port has to be shifted either ahead or delayed then we will be involved and arrange everything with the agent shoreside so the ship does not have to be involved with it and then we will arrange everything with the agent in the part

INTERVIEWER: How do you usually communicate with these actors

PC1: Normally the captain will give us a call and inform us about circumstances about whatever is going on and then we will go in contact with the agent. Also if it is very urgent we will try it to give them a call, if it is not urgent and we are planning to or three days ahead we normally just write them an email and wait for the reply.

INTERVIEWER: How well does that usually work?

PC1: If we have enough time also depending on the country or the ports if we have enough time especially if it is during the normal working week between Monday and Friday, we get a reply within 2 or 3 hours. If we write an email. If we called them directly is also works out quite well. On the weekends it can be a different story. The agents are usually not checking their emails on the regular base so we tried to give them a call. I have been also cases where I tried to get them on the phone for several hours. But in general, as I said between Monday and Friday it's quite good.

INTERVIEWER: Okay so if I understand it right one of the main factors influencing the quality is the availability and the weekday.

PC1: You mean the weekend?

INTERVIEWER: Yes.

PC1: Yes, the weekend.

INTERVIEWER: I mean the service providers ashore on the weekends Is usually below par on the weekends. Are there any other factors which influence the success of these interactions?

PC1: It is always a three-way communication back and forth between the ship and the Agents. If we communicate via email, then everybody can be in copy and can follow up on the communication. But especially with information on a phone call we have to transmit this information back and forth to the agent and the ship. So that could be an influence as well but that's it.

INTERVIEWER: Do I have any idea or thoughts how that communication could be improved even more?

PC1: You mean this three-way communication?

INTERVIEWER: Yes.

PC1: Honestly, we have these cases where are the ships are dealing with the agents themselves via the first Purser sometimes the ships decide to arrange the berth them self but then of course we are left out. Normally they clarify it on their own and write us a quick email about what has been discussed. Either you have direct communication with the telephone which can be done straight away but only between two parties or you have all parties involved with an email, but you have to wait for a reply. Just a mixture of both would be perfect but that is not possible.

INTERVIEWER: Overall in your experience what do you perceive as the major challenges in a cruise ship ports call?

PC1: Can you clarify?

INTERVIEWER: Do you see a trend towards problems or recurring situations which pose challenges?

PC1: The major concern for us in the cruise industry where we have to intervene in the normal procedure are the weather conditions. This is for us the major aspect and this is why we are monitoring this closely all the time in our operations. So, this is I would say the major factor affecting all operations and second of all one of the major factors in the recent past are strikes going on in different countries. So, the political situation where we are uncertain what kind of support we can expect or if we can perform the call at all these are two major factors. Maybe what you can also mention our technical defect on board which have impact on the speed of the ships which can also lead to delays on arrival.

INTERVIEWER: You mentioned the weather and port strikes. Do you have any idea how much impact it has, for example in terms of economic impact guest satisfaction on your operation and so on?

PC1: It depends on the (type of operation). For some ships it is quite a big impact if we have to change ports especially if we have to cancel ports completely because these ships have a partial turn around in every port. So, it impacts them a lot and also the flights which then cause a big Financial impact. Then of course we have ports which are the major highlights on the cruise and if we cancel those because of weather or if we cut the port call short then of course it impacts guest satisfaction Also of course it has an impact on the shore excursions booked with the financial and guest satisfaction impact. I would say those are the main impacts.

INTERVIEWER: How much coordination does those situations require?

PC1: It depends on the extent if it does a delay of only one hour it has only a small extent. Maybe some Excursions have to be cancelled so the supplier of those excursions has to be notified areas if the delay is bigger or the port is canceled all together of course the logistics behind that are quite big then the entire response team is involved so all the teams which take care of the guests and in our office the entire Port operations team security team possibly also the human relations team in the office and on board in case there is a crew change scheduled, Our technical teams they all have to be involved because normally it is affecting pretty much everything. So normally it is a big logistical and financial impact.

INTERVIEWER: With whom of these parties do you specifically communicate then?

PC1: Me personally not with all of them. They all come together, and we all have our own software to inform everyone automatically via phone or email, so we just start this information process. And all teams are notified.

INTERVIEWER: That is a company internal software correct?

PC1: Yes correct. And this software informs everybody regarding the issue and then everybody gathers together in one room then one of us from the operations Department gives a short introduction about what happened and then there is one person who takes charge.

INTERVIEWER: How well would you say does that system work?

PC1: I would say that system works quite good it is quite interesting because when all the parties come together there's always something coming up what's you have not thought about what can be impacted by this issue so that's why it's important that everybody comes together because in here in the office nobody has a complete overview of what everybody exactly does so it makes sense for everybody to come together and also this information system which we have Works quite well.

INTERVIEWER: (discussing specific details of that company internal software) How important is the communication between Port and to ship for you?

PC1: As I said before it depends on if we are involved by the ship if they want us to interact with the forward or not. Otherwise the ship is also doing it themselves sometimes via the first Purser but of course it is very important because we have to arrange everything including Pilots linesman shore excursions which have to be rescheduled so of course it has a very big impact. Not only for us but also for the port.

INTERVIEWER: And how important is in case of rescheduling the communication between the old and the New Port let's say the Port- Port communication?

PC1: Don't take it for granted but to my knowledge this is not done and not important if we have to reschedule, we just get in touch with the Newport and the agent. Maybe it is the same agency end the same agent then it will be different but usually it is a new agent and the communication is only with him.

INTERVIEWER: (short introduction & description about data sharing concept) what possible value would that bring for your operation?

PC1: It would help in case of rescheduling when we have to look for alternatives and it is quite a long process until we get in touch with the Newport and clarify everything is Everything can be arranged as we need it so that takes quite a lot of time. Especially if you have to check multiple options not only one alternative but maybe three or four or five. This process could be made easier and speed up.

INTERVIEWER: For these situations when you get in touch with the ports what type of information is most important for you?

PC1: First of all, of course the availability. Then of course what type of documents they need in some cases they tell us yes, the berth is available and then in a second email they tell you have to send also all documents 24 hours before the ship is supposed to arrive in 10 hours then of course it is not possible. Additional information is important to 4 example availability of Bunker barges such information is vital for us to decide if this port is a alternative or not. And sometimes it takes more time to collect this information because questions come up later and then you have to reassess the whole alternative again.

INTERVIEWER: In our thesis we are looking at one specific system more closely, PortCDM, we talked about it briefly before. (briefly explain PCMF structure). In what situations would you think such information is not enough?

PC1: I mean this information we have available anyway. We have one internal software where we collect such information, when is it scheduled to arrive, when it is supposed to leave, talking about searching for alternatives end when a ship could arrive, regarding speed, that we can calculate on our own. For us it is more important information like is the berth available and if yes can we do all our necessary operation for example fuel bunkering, water bunkering, garbage disposal and so on.

INTERVIEWER: One major part PortCDM would be a technical standard which is available to all parties including third parties like bunker barges. They would be able to see you such information as well which might enable receiving faster feedback what do you think.

PC1: Well the bunkering is always a special part because we have our own department for bunkering. And I know that they are always in touch with a different part of the company who are mainly responsible for fuel bunkering and they have their own processes and I am not sure about these processes. But it is always

more complicated with a bunker barge than saying alright we go here and the bunker barge it's following us see, there is always more processes in the background.

INTERVIEWER: If you had the technical possibility to share data with all actors involved in a port call how would you utilize that?

PC1: Well the easiest way I can imagine is one platform where everybody has access to and you can just check the availability with one click end the agent can respond, and where all the subcontractors for example buses and garbage disposal also have access to and there they can confirm their availability with some details. And then you would have some form of checklist and then you could see it okay all of this operation I have to do, they are possible in the port or not. And then on the second stage I could confirm the port and I could see you somehow the financial cost for the sport for example the individual cost for the suppliers, then we can make a decision if we go or not, yes that would be the easiest way for sure.

INTERVIEWER: How would you think can enhance data-sharing capability help you to avoid the underlying issues which leads to rescheduling or any other problems

PC1: In my opinion for the weather it is no option at all. Of course, sometimes we sometimes Adept the port call for example arise a bit earlier or later if we get a weather forecast but if the weather in conditions do not allow the port then it is like it is and then there is no communication to which can avoid this. We also stuck to the schedule we have so we cannot adapt however we want we cannot say if we cannot go today then we go tomorrow. Also, the other reasons for example Port strikes or political situation there we have no influence at all. Of course, for us the most important is to be aware about these situations as early as possible so we can react to these circumstances and react as fast as possible. But if we reschedule the ship, I don't see any way we can avoid the reason. Most of the time they're out of our hands and I don't see any way to change this

INTERVIEWER: What opportunities do you see to collect and use this data for your own use?

PC1: We are in a situation that we already have a lot of information with the software you have maybe this is a bit Limited end the communication with the shore Based Services like shore excursions are linesman could be enhanced because right now this is all done by the agent. But honestly, I don't see a lot of situations where I can say this was not done properly. Sometimes though the agent needs quiet while to find out if we can make a change or not. So sometimes we ask him if it is possible and he takes a while to call back. I am not sure who they have to contact probably a lot of parties, but we are not the part of this process and we just contact the agents and that's it.

INTERVIEWER: You mentioned before the information you have regarding incidents which are caused by weather or strikes or anything else. Do you record these?

PC1: Yes, all of them

INTERVIEWER: Do you monitor your overall performance?

PC1: Yes, we have a lot of monitoring systems about what is going on on board and we collect that information,

INTERVIEWER: Do you create key performance indicators based on that?

PC1: I am not completely sure. We collect and keep track of these incidents end forward them to other departments, but we are not involved in such output.

INTERVIEWER: (describe quantitative analysis and three main reason findings) What are your thoughts on that?

PC1: As I said regarding the weather, we don't have any influence and even if we are rerouting on a short notice, I don't really see the benefits of advanced data-sharing. Well we have our own system and it is beneficial here. Regarding the third part regarding delay at departure because of any operation there I

agree for example shore excursions arriving late bunker barge being late that will affect the departure - these are information's which could reach us earlier because normally these come to us when it is already too late. And then it is also not clear where for example the buses are can, they really come back to the ship. So, this this is all uncertain and of course also impacting the ETA for the next port. So, there I see a chance if the third parties are involved in the communication that would be very beneficial for us if we could have this type of information earlier.

INTERVIEWER: And if I understood you correctly earlier in those situations your main contact would be the ship and the ship is in contact with the port and the agent correct?

PC1: Yes Exactly. I mean in general we have also a good communication channel to the agent because we can just call him buds we are not involved with the third parties for example 1 cup barges or shore excursions they're the communication is always done by the ship.

INTERVIEWER: Regarding any delays which have an impact of less than 1 hour do you get any information about those?

PC1: It always depends on the captain. Some captains are aware that they don't have to report this. We got a notification via our system anyways, but if they depart for example half an hour late and they don't call us it can be that we are not noticing those delays.

INTERVIEWER: The notification you get the ship departs late from where does the notification come also from the ship?

PC1: Well if they're late for more than one hour they have to report to us which they know so this information we get anyway. But also, the software we have to monitor our ships will notify us when they are late at departure.

INTERVIEWER: It is the same internal software which looks at the position data and then says that ship was supposed to leave at let's say 6?

PC1: Yes. In the ideal case that's how it works.

INTERVIEWER: How well does the work?

PC1: 50/50.

INTERVIEWER: Okay. How are useful would it be than to have such a and on sharing capability or a system which connects all the actors and where you would for example has a notification from the port that that ship has left the berth, dropped the pilot?

PC1: Honestly this is not too helpful for us. If the ship is late by let's say 40 minutes, it does not impact our operation at all. To my knowledge there is no call where we have to be hundred percent on time. Normally the ships arranged this on their own. And if they have any problems, they give us a call anyway. And if we have a system which tells us that the ship is at the berth 17 15 and it was scheduled 1700 that is not beneficial for us. Because there is no output for that information and nothing, we can do with it.

INTERVIEWER: And also, if the ship is departing half an hour later and therefore has to increase the speed to arrive in time at the next port what about that?

PC1: Well half an hour delay how much is this going to affect the arrival speed? Not much. And I also tell other persons in my company: it is called ETA which stands for estimated time of arrival otherwise it would be TA - Time of Arrival.

INTERVIEWER: Reflecting on what we have talked until now is there anything do you think is important or something we missed?

PC1: In general, I think we are in a special position with all our tools we have. One thing that I think could be improved is a sort of platform where all actors and not only two actors come together. Especially the

communication with third parties could be enhanced. Also, the communication with the agent could be more efficient. Communication between ship and us I don't see any room for improvement. However, for communication with third parties or three-way communication I mentioned, us, ship, agent, there could be some improvement for sure.

INTERVIEWER: Thank you for the interview!

7.8.4 Interview with PC2

INTERVIEWER: Can you briefly describe the scope of your work, and specifically your involvement in port calls of the ships?

PC2: Yeah absolutely. We have, as the management company, different tasks that go beyond the port security. Just briefly, this includes the security investigation, the incident management when it comes to security related matters. Pretty much everything that may occur onboard, so crime plus all the incidents that may occur ashore. Referring to terminals, it's sort of divided. We do have a duty to report however the terminals are solely responsible for the terminal management or the authorities. Nevertheless, we do the reporting if this affects the passengers, crew or the vessel. Next, we do port security in terms of budgeting, the requests for specific services, which could be standard services which could be shore security screening, or special services like the search of tour vehicles used for tour excursions. It would be a special request. Port security, and the entire part, compliance and flag state regulations, ship security plans, processes, our own manuals on top of what the corporation requires us to do and the flag state requires us to do. These are the three columns, port security, destination security and criminal investigations and the compliance part.

INTERVIEWER: Okay, and when you look at new ports and talk about destination security. What kind of information is relevant for you then?

PC2: First of all we look into the destination from a broader perspective, so the country risk. This includes terrorism, civil unrest, crime. To certain extent we look into matters such as maritime security, piracy and stowaways, everything which is related to destinations which is both land and water. But let's focus on a country. So we have the country risk, then we break it down to the port destination, and potentially the shore excursion side. Things outside the port. For instance, Israel with the port destination Haifa, and the shore excursion to Tel Aviv and Bethlehem and so on. So beyond the port parameters. Then if we receive such a request, we look at the duration of the call, is it a day-time call, an overnight or a long-time charter. This has an impact on the security. We then have certain key dates, such as Ramadan in the middle east. Different impact on the assessment. Last but not least we look into the port facility in terms of infrastructures and security measures in place, to then evaluate what we need and what we need to do on our own, because of lacking facility, infrastructure or quality or various reasons.

INTERVIEWER: How much of this information do you actually get from the port, or actors within the port?

PC2: Country risk… I mean the entire country thing is a little bit tricky, and this doesn't refer to local nationals necessarily, it could also include like ex-pats or representatives at the missions like consulates and embassies. They may have a different point of view after a certain period of time. So for us it is important to get an unbiased picture from a third party, while indeed get feedback from ports and tour agencies. We do get feedback from local contacts such as the missions or NGOs and we sum it up, but usually there is a slight difference in the awareness. Overall yes, ports and tour agencies provide feedback, yes, but the main information we receive through what's called intelligence vendors. So, we purchase the information. So known vendors are for example contra-risk and international SOS. To have an idea about the destination and the country risk comes down to the port. We either utilize information that is available within the corporation or from the local agents.

INTERVIEWER: Very interesting. Then if we look at the day when the ship is in the port and they have the actual operation, how much involvement do you have from your point of view?

PC2: A CSO is in charge for the security of the vessel, so it's on us if we outsource certain services to the port. The port has a port facility security plan which means there are for example exit restrictions in place. However, the screening which occurs in terms of luggage screening and screening of persons is done on behalf of the vessel. So, when it comes to specific ports, we do decide with the SSO what needs to be improved. Usually we do the set-up upfront. We discuss with the port, either what is mandatory anyways, or what we want. As soon as the ship is in port, it's on the ship security officer to validate that everything is in place, if there are any vulnerabilities. For example, a hole in the fence, or improper screenings, no pat down of passengers whatsoever. He then discusses this with the PFSO or the security provider or terminal manager, whoever is in charge. This is done at the day of the call.

INTERVIEWER: So to say it in other words, correct me if I'm wrong, the main focus is on having a good setup, have a good plan in front and to also make sure it also works out when the ship is in port?

PC2: Right, we define what we want, and the rest is basically just quality assurance or quality management.

INTERVIEWER: Right. Let's say something would happen. Some incident while the ship is in port. Let's say an accident in a shore excursion bus or in the port, what type of information is most interesting for you in that case?

PC2: Lets do a shore excursion example. First of all, what kind of incident is it? Is it a medical, safety, security?

INTERVIEWER: Let's say it is a security incident.

PC2: Let's say a minor theft, someone stole a wallet. Nothing really crucial that would require immediate action. Guest returns back onboard and reports to the front desk in most cases, and we offer assistance if there is enough time to take the passenger to a local police station, to announce this theft to the police. That's pretty much it. We're pretty much not in charge, but we offer assistance. What we are in charge of is to inform passengers of certain risks, if we are aware of them as a sailing company. Let's say we have this, I don't know how well it is known, but we have this reference which is known as the Coby beach case. The company had knowledge of how dangerous a certain area was, where subsequently the passengers were victims to a robbery. They took this to court and by the end of the day it was decided that the company has to inform the passengers if they are aware of certain risks. In this particular case, pickpocketing is not a big deal, but if we for example have an occurrence of a big protest and the police are taking non-lethal actions such as rubber bullets, tear gas and so on, usually our tour guides and scouts should try to gather the group and leave the area . Preferably back to the vessel. What we call a contingency plan would be in place, to have everybody accounted for and either proceed to the next excursion site or back to the vessel. It depends on the urgency, and for example if there is an injury from pepper gas. Port incidents… in ports someone needs to be in charge, and this person immediately needs to be called. It's either the authorities or a security provider or PFSO. Unauthorized entrance for example. A person shows up at the gangway and it turns he was able to enter the ISPS area without proper screening, without being asked for his or hers ID. This is an incident which immediately needs to be reported to the port, while we just pretty much take a note if we can exclude that he poses a threat to the vessel. But that is something that occurs in an area that falls under ISPS, so the port management is in charge. On shore excursion nobody is really in charge. It's more of a responsibility. Tourism police for example, we would have to deal with those. In most cases it's due to irresponsibility of a guest or a crewmember.

INTERVIEWER: You mentioned the contingency plan, for example for the scouts and the buses. How much coordination from you or the security officer is involved in that? Do somebody have to communicate with them and say, "now you have to start the contingency plan" or are they more or less self-organized in that way?

PC2: Corporation has defined destinations in which we have to have a contingency plan. Prior to arrival in those destinations, the security officer in charge makes sure we have a contingency plan prepared which pretty much includes directives for the scouts how to manage the guests in a certain situation. Pretty much the first bullet point is "make sure everybody stays calm", and then it includes communication lines, gathering points. If an incident occurs at a certain place, we have defined gathering points, assembly points. Perhaps at a hotel where the guests had lunch earlier, so they pretty much know about the location. We assume the hotels have dedicated security. It is a much better choice than police stations or hospitals. The plan usually includes a small map, telephone numbers, guidance for the scouts, how to manage situations. This needs to be made available to every scout before starting the excursions, with updated information. Especially when telephone numbers change. That's pretty much the idea of contingency plans. We may implement the plan beyond what is required by the corporation if we feel like in this destination there should be a plan in place as a precaution.

INTERVIEWER: That's very interesting. (Explanation of thesis topic and data sharing/Port CDM) …the idea of this concept is to have more situational awareness for all people. When you hear about this concept, what are your thoughts?

PC2: I mean it can never hurt to have information available. Maintenance is to my mind the most critical. To keep things up to date, and then it's always the questions if it's push or pull when it comes to access to this information. I like the idea. There are certain platforms in place if I'm not mistaken. For instance, CSO group for security related matters which is shared amongst commercial vessel officers, other than passenger vessels. You need a solid and sufficient internet access to access this data. What we see on the shoreward site is to have broadband, so slow and fast access. This must be enabled, someone needs to be in charge to pull the information, and then it makes sense to have a proper data base with a defined access and utilization. When I look into certain databases there are too much information that is useless. There must be standards what is required, what is standard and makes sense. To limit the volume and make it more useful. Other than that yes, it never hurts to have data, it's that simple.

INTERVIEWER: The focus of most of these concepts is to share data in real-time, so that you don't have these situations when there is a schedule change and somebody has to call person A, person A has to call person B, that person sends emails to other people who takes hours to read it. It would be a focus on sharing information quickly. Then again before we talked about that, your focus is to have a good plan up front, and then validating that plan. How much value would you see in your information for sharing this real time data?

PC2: From a security point of view?

INTERVIEWER: Yeah.

PC2: Well if I looked at yesterday, April 28th there were elections in Spain, so it was of the utmost importance for me to know what was going on in the cities at every moment. When the poll stations open, when the first results are in, any specific key figures going to vote, what is going on around that. Luckily when it comes to such popular brands, we utilize open source media. We can even check certain web cams that are installed around Marseille, Barcelona, you name it. But from a ship point of view does this have an impact on shore excursions… we do maintain corporation with cruise lines or brands outside the corporation for this very reason. It is always in real time, but it is again this classic email ping-pong. Someone might read it in due course, others may not. Some responds, others don't. It's not like the

information ends up in a database, but from a security point of view if there are certain developments, it makes sense indeed. The vendors which I mentioned earlier, usually the information is dated. Other then notifications sent by these vendors about a specific event, there's not really any live monitoring.

INTERVIEWER: Okay. The corporation with the other companies, do you have a common platform or is it purely mail based?

PC2: It is purely mail based. The reason for this is that all the major cruise lines meet on a regular basis in events organized by CLIA, relating to environmental, security matters and so on. Part of the security committee are indeed the persons in charge of the intelligence. They do indeed exchange information. There is no competition when it comes to security. Which makes sense, but this email-based sharing, it has been decided in the past not to upload this information. First of all, it's sometimes single source, and nobody wants to be finger pointed at if it turns out that the information wasn't correct. So we take this information as a puPC2:le piece, so it's either true or not, but it's better then having nothing. So it's email based and it pretty much refers to let's say the big four in the cruise market.

INTERVIEWER: For example when we talk about the contingency plans and shore excursions checking in at a hotel, would it also be a possible application that you get let's say a check-in of "this group has arrived at check-point B", "this group has arrived at check-point C". Like a checklist so you can see what groups have reached a certain stage in the plan.

PC2: Yeah, absolutely. There has been an initiative... At a certain point we are selling the excursions and at least in the morning when the passengers embark a bus we track them using handhelds. The long term idea is to track passenger movements throughout the day. Who is leaving the bus, who is returning to the bus, who is missing for whatever reason. They either missed the bus because they mixed up the time or they were subject to maybe traffic incidents or accidents. Utilizing the handhelds which we already have, but are offline during the duration of the day, and tracks when everybody is back. That's an idea. There is are other means, like sms to provide verifications when the bus has arrived at a certain site or passed a certain checkpoint. Things like that. Communication through telephone.

INTERVIEWER: When we talk about these data sharing… there is always the possibility to record data over long terms. Let's imagine we have this system where we have real time data tracking of relevant security information, like the polls in Spain. How it develops throughout the day, if there are potential hotspots in the city. Let's say such data for every port a ship is in over the course of a year, what value would that have for you?

PC2: Ports are kind of unique, but lets say we have the May 1 protests or gatherings in Istanbul for example. In this regard one year is not necessarily enough if you into any annual events. It would be good for certain events to have 3-4-5 year records to see for example what's the potential and what might occur at May 1, what sites and what potential impacts and police responses. Cancellations of the entire day if it can not be contained, or avoid certain sites like (town square-specific location). Changes to sequence of calls, sequence of excursions. There is a lot of value in having information that refers to specific events. Or let's say in Spain we know that port workers frequently calls for strikes so now our experience shows that cruise operators are usually not affected. So it would be good to know the impact of certain industrial actions, so we know potential outcomes.

Say Israel for example, explosions, incidents that involves cars. In our experience in 99% of cases, this is linked to organized crime, and not terrorism or any acts of militancy. This is something from one or two events, I will not know much, but after many events I will know impacts and effects for foreigners, guests and so on. So yeah, it makes sense.

INTERVIEWER: Very interesting. Let's say inside the city, is there any value of having historical information, that if something happens, an explosion or even, let's say a public demonstration, that these certain areas are especially affected. Is that something worth knowing and monitoring over a certain historical period?

PC2: Right. Yeah, that's what we usually refer to as flashpoints or hotspots. Makes from a security point of view a little easier, because we can say whatever happens, likely happens there. A protest, a roadblock, the risk of being subject to theft. We kind of have a good idea of where these things happen, and at what time of the day. That's why initially referred to day-calls and overnights. Usually we have a significant increase in crimes after sunset. Caribbean for example. Then it's important to know what time, what place. Yeah absolutely.

INTERVIEWER: We also talked with other people, and one suggestion was for example: If scheduled changes occur, and a ship needs to reschedule or even go to a different port, it would be interesting for that person to have a platform where you can go and you see: "these ports in the vicinity are available, and these services are available at these costs and times, these slots would be free". That's of course from a planning perspective. How useful would that be from the security perspective?

PC2: Speaking of not only threats or specific risks, but also from availability of infrastructure there are services that are cost-related. It makes sense to know what terminal, what dates of the week when looking into cost structures. A Saturday and Sunday can cost double, or if it is a holiday. It would good to see where's the ship berthed, do we have infrastructure in place to do screenings, how far is it to the buses, is there potentially canine, sniffer dogs available in that specific location. But then looking at the dates and times, usually we have to combine this information, because it would overwhelm the database. Take for example a call to Israel on a Friday. It's not necessarily the best day of the week in terms of potential. We would have to merge this information, let's say what it would mean to call on a Friday vs. a Tuesday for example. In terms of location of the vessel, based on that we may have a variation of excursion sites. Israel again for example, you can go to the dead sea from Ashdod, but you can't get to the dead sea from Haifa so it would be of interest to know distances to certain sites and durations of the calls. I don't think a database can fully replace knowledgeable managers or personnel. In the end someone needs to be able and capable to read the information. What does it mean, sunset at 19:00 or sunset at 21:00 in terms of risk? A port planner most likely has zero information content wise, while a security person would understand. It's good to have the information, but the right people will need to read it and work with it.

INTERVIEWER: Interesting perspective. I absolutely agree that port planners would be overwhelmed by all the security related information. It would be a lot to digest. Another feedback or finding we got is that some people said that having information in a standardized format would be helpful for operational personnel who are involved in a lot off communications, specifically the purse onboard and the agent ashore, who are constantly on the phone or sending emails to a lot of people. You're not on the operational side on the ship, that's the SCO. How much potential do you think a standardized data sharing system have for the SCO onboard?

PC2: I mean it's a good questions.Now, I am referring to all the decisions taken onboard without involving the SCO. It is usually smarter to involve security at a very early stage. I mean there are some negatives, the SCO is involved in the operation, it starts with setting up the gangway in the morning, ensuring that the passenger movements are properly managed, so my biggest concern is the changing responsibilities on a pretty much permanent basis. To take one brand for example, (brand name) to take the pursers responsibilities to switch over to a port operations manager, to then maybe switch over again to whoever, so the standardized reporting would either include too many people, distract from the attention of the right people, and be subject for permanent adoptions to catch up with all these operational changes. I think that some key positions should be in a permanent ? (38:35), no doubt. We also have to look into

which brand is intending to assign certain duties to certain people. I think in recent years it's been a lot of change…

PC2: I mean too many people is a bad thing, but if you have 1-2-3 positions at the top, like security, I mean they're all adults, they can delete a message if it doesn't affect them, rather then not being informed at all. So, to sum it up, standardized formats which are kept short would be preferred.

INTERVIEWER: Very interesting. Coming now to the last part of the interview, (Introducing thesis quantitative data analysis) From a security perspective, how much is your operation affected if a ship is late, or even too early?

PC2: It may indeed be significant. For multiple reasons. If I do have a service agreement in place with screening activities performed ashore, technically all the screeners at a certain point can stop their duties and walk home. So it's more or less a gentlemen's agreement that people proceed with their work, sure we are subject to a surcharge which may even be considered double time or overtime. Charges are a lot higher then. Usually a delay is caused by lets's say traffic. So I have a higher amount of people returning at a much shorter period of time. Delay might be one single bus, or one airplance being late. But usually when we have excursion tours returning from let's say Rome, or in the past Kairo, we are talking easily 20 buses that are late. So I need to ensure a sufficient amount of screening personnel are there, and manage a lot higher percentage of people at a much shorter time, which might interfere with my standards. Proper screening of a person takes a certain time, and they might not have the time because the Captain is pushing, or the circumstances are pushing, high tide or low tide, the availability of pilots. Interfering with security standards is never, never a good thing. Delays and the overtime, potential violation of MLC. We have to be clear, security starts at least 30min before arrival and 30min after departure, and stays all day, so working hours are 10h plus. That's why every delay is a problem in terms of cost, in terms of quality and in terms of potential violations.

INTERVIEWER: Allright. How about if there is too strong wind in one port, and the ship reschedule the night before to another port. How would that affect your operation?

PC2: Well, I mean we then have to at a short notice check the availability of security at that port. Usually that comes with the port assignment, so if the port and the berth is confirmed, the port has everything in place. In the very rare case where we have an exclusive agreement with a certain provider, there are notice agreements of 24h usually, so it should be manageable. Every ship is prepared and trained to do the entire screening ashore, so in terms of screening, it can be managed. Events in that destination, I'd say in 99% of destinations are feasible. It is very, very unlikely that we have an incident that tells us that you can't go there tomorrow. Let's say the May 1 for example, might not be an issue on a Greek island, like Santorini, but may be an issue if the ship calls Athens or Piraeus. That the May 1 events has an impact on an island is rather unlikely, but again that happens only maybe once a year that we say that "hey, from a security perspective this might not be optimal".

INTERVIEWER: Interesting. So if you can make a very rough estimate form the top of your head, how many port calls do not go as planned, and have major problems? Like shore excursions being cancelled or the ship leaving early due to security reasons.

PC2: Maybe three times a year.

INTERVIEWER: From all ~40 ships?

PC2: Yeah. Usually we have to make these decisions on a very short notice when it comes to Isreal. Changes might affect the entire sequence of port of calls, or excursions to certain areas. But if something occurs which has a security impact, it's been Israel or in the recent past blockades hindering the access to a port like Marseille linked to the yellow vest movement. So let's say 5 a year…

INTERVIEWER: (Closing niceties) Is there anything from your side you think we forgot to address?

PC2: No, but maybe after review, maybe there's something I'll remark to which I'll provide further information. But for now in terms of information sharing… I mean again, there are country risks, destination risks, there are databases in place which pretty much everybody utilizes. But it does not really refer to ship, or events linked to passenger vessels, there is not such database in place. So, form a security point of view it would be good to have it, maybe somewhat more summarized, starting from stowaways, attempts to get onboard, but that's something that the corporation usually considers confidential. Not sure if this would end up in a database, but I think the direction is right, so it would be nice to have that overview.

7.8.5 Interview with PO1

INTERVIEWER: Can you briefly describe what your role in a cruise ship port call was?

PO1: I have been onboard as a first purser, or a clearance officer as it's also called. I did the clearance when we came to port, and also before we came to the ports I did everything for the clearance and the upcoming call. I was the main contact person in the ports between the ship and all involved port parties. I think that's mainly it

INTERVIEWER: What methods and what communication channels did you use to coordinate the port call?

PO1: mostly we did everything in advance by email, and when in port when something needed to be communicated very fast, also by telephone. Most of the time via email.

INTERVIEWER: how well does that usually work?

PO1: Well most of the time good, but sometimes better and sometimes not so good. It mostly depends on the agencies. Some of them I think are sitting in front of their computers or smartphones all the time and you get the answers very fast and efficient. But of course you have some agents and agencies where you don't get any replies from hours or days, and of course you needed to make decisions. Quite often it was very difficult, and you needed to send reminders and so on.

INTERVIEWER: Do you think there is a geographic factor to this? Do you generally feel the service is better in certain parts of the world, or is it merely up to the individual agency?

PO1: Yeah, so I think I little bit depends on the culture. (…) Germans wants to have our answers very fast and in time. Many places in the world have other ways to work, but it also depends on the agencies and agents. Wherever you are in the world, you need an agent who works very fast and is efficient. I think it's the agency most of the time that are not doing a proper work.

INTERVIEWER: Do any other factors come to mind that influence the quality of the port call come to mind besides what you just mentioned?

PO1: Hmm… I think it's quite difficult because you need to communicate with all the people onboard and also the agencies, so when something unexpected happens you need to communicate with everyone and be on two phones at the same time. That can be quite difficult.

INTERVIEWER: Okay, interesting. What would you say are major challenges and problems in general in the port call?

PO1: I think most of the stuff has been organized a few weeks, months or years in advanced, so everything is organized quite well. But sometimes you have immigration matters that are unexpected, or immigration wants other documents and so on. Usually it was the unexpected things that made life difficult

and challenging. Especially on embarkation day with delayed airplanes and passengers disembarking and embarking. It was the most challenging.

INTERVIEWER: From your perspective, what is the impact of these problems?

PO1: I think the impact is of course the happiness of the quests, that is of course our main objective, to make the passengers happy. If you have any logistical issues with loading or excursions. If things are not running smooth it will impact the happiness of the quests. So that is a big challenge with a big impact.

INTERVIEWER: Interesting. What do you think could be changed to make these situations better or avoid these problems?

PO1: I think faster communication would make it better. So that if we have any changes we can quickly communicate it onboard, and with all other involved parties, is it makes it easier to make fast decision and react fast. You don't have much time to plan ahead.

INTERVIEWER: In any situations during the port call, how important is the communication with the port itself, besides the agent?

PO1: I think it's important when it comes to security matters. So I know from the (…) vessels the when the security checks have been done outside the terminals, where I had communication with a security officer. Otherwise I don't have much communication with the port itself, but rather always via the agent who was talking to all involved parties.

INTERVIEWER: How is it in case of rescheduling ports, how does it work from your perspective?

PO1: I think me as a purser got the information from the bridge or the captain. I had to contact the agent to verify if the port was available at a later point or time, or if we could skip the departure. For the excursions it was also very important to inform the excursion agent to reschedule all the excursions, and to guarantee that all excursions would take place for the guest. Also services we had in the ports, like provision loading will be disrupted if the ship was arriving later in port. Bunkering for example. If it's only a port you go to for some excursions it's mostly very easy to reschedule.

INTERVIEWER: Again, this rescheduling process would be done by email or phone?

PO1: Yeah, most of the time via phone, because everyone wants to have fast information. Everything needs to be arranged very fast.

INTERVIEWER: I remember the last time we spoke, where you mentioned the internal software used onboard, if I remember correctly this software is mainly for storing general information and invoices. It can be accessed from other parties as well, but it is not used for short-term coordination or rescheduling. Is that correct?

PO1: Yes, that's right.

INTERVIEWER: We talked before about our project, what we're doing. Mostly about one specific concept, but we are looking at enhanced data sharing capabilities in general, and how they can be used potentially in the cruise industry. These data sharing concepts are about enabling the sharing of data with all the actors in the ports, sharing it in real time. The concept that we are focusing on is sharing timestamps. That is something that would increase the overall port call efficiency and reduce delays. What is your general thought about such data sharing capabilities, and what possible value would it being for you?

PO1: I think there is a quite good and real possibility, but everyone would then need to utilize this possibility and share their data. If everyone is using it, keeping their data updated and are online all the time, the I think it is it's quite easy to work with and quite easy to avoid any communication mistake. You can

keep everyone in the loop very well. But I think it needs to be assured everyone is using it in the way it's meant to, then it's a great idea.

INTERVIEWER: Where would you see potential in such a concept?

PO1: I see potential in better and fast communication, that makes the communication onboard easier, and with the people ashore. I think you can reduce the costs with the port agencies. The question is if you need a port agency then, or for which services you need it then. It might be interesting from that angle. Yeah, I think it will make faster and more efficient for your decision-making, especially in unexpected events.

INTERVIEWER: I mentioned making decisions faster. Can you name specific situations from your experience when quick decision making would be important?

PO1: I remember one occasion when we were in Dubai and couldn't get our provisions because they were stuck in customs. Then the decision had to be made if we should stay in the port of Dubai. It was however not possible because the berth was not available for us, so we needed to go somewhere else. So, then the question was to which port could we go to, where can the provisions be sent to, what port can we skip then and so forth. There I think the communication was not very good, with the shoreside being involved because of the loading, the ship being involved of course, and the custom being involved etc.

INTERVIEWER: In a situation like you just mentioned, what communication is the most likely to be more of an issue, the communication between you and the agent, or you and the (shoreside operation)?

PO1: I think with the agent. Because sometimes we think they don't understand the importance, and that the decisions have to be made. Also, for the quest satisfaction we need the provision, so yeah, the communication with the port agent was difficult. But honestly, I think it's also difficult internally. Sometimes the information gets lost in the chain between for example the captain and the shore excursion manager, to the first purser, to the head office, to the shore side and vice versa. It's likely to sometimes lose information.

INTERVIEWER: Okay. (Explanation of PortCDM concept and the port call message format: Time-Status-Pos-Party) Can you think of any situation where this type of information would not be enough?

PO1: No, mostly I think that's the information we need on a cruise ship. So, bunkering at what time, provision on what time. Of course, if something is delayed, we need to know until what time it's postponed. That would be enough.

INTERVIEWER: All right. Talking about data sharing, we already mentioned using it in case of unscheduled event deviation. Can you see any further application for enhanced data sharing capabilities?

PO1: No…

INTERVIEWER: Totally fine, we don't have any agenda here! Just interested in your opinion. How much potential do you see in enhanced data sharing capabilities to help you in your long-term planning?

PO1: I think it could help a lot. It also needs to include… this is one of the big issues we have on cruise ships, that each port needs to have all information, like guest data and crew data in different forms. You have several systems where you have to upload the files, so of course it would be great if such a system could include sharing this type of data. To make it more globally standardized, so not every country and port have different systems.

INTERVIEWER: How much possible potential do you see in the possibility of collecting data for your internal use?

PO1: I think it would help for preparing for calls in the same area, and for other seasons to get some knowledge, and to know what is to be expected there.

INTERVIEWER: How would you do that in relation to the software you have already?

PO1: I think everyone needs to ensure that the data is updated all the time, and that everyone is using it. Not just that it is another system on my computer, but I don't want to use it. That needs to be ensured, I would of course use it as much as I could.

INTERVIEWER: How was it when you worked onboard, did you keep track of let's say your performance in the port calls? For example, if there were any unexpected delays or incidents.

PO1: So, for me, after every call if there had been some incidents or unexpected events for me it was important it was important to get some feedback and improve the faults for the next call. Make a smoother call or whatever. Preparation has always been a big task for me. I think it's very important to see what went wrong and to make it better for next call?

INTERVIEWER: Okay. What that your own personal policy, or company policy?

PO1: I think it was my own policy.

INTERVIEWER: Okay, what potential would you see in avoiding issues that would lead to unexpected events or incidents in the port call?

PO1: I think it has a high potential. For example, for immigration matters. One morning we had an immigration officer coming onboard and said that two of the passengers had to come to the clearance otherwise the ship will not be cleared. If we knew something like that already on the previous evening, we could have informed the passengers, and everything would go much faster. I think we could avoid things like that. Also, with loading provisions. Knowing in advance that customs are not as fast we could schedule the loading for a later time during the day when we knew they would be finished with the clearance. It would help a lot to help avoid that.

INTERVIEWER: (Explanation of the quantitative data result and the scenarios) What are your thoughts and perspectives of these findings, do they match your experience?

PO1: Yes absolutely, I think these are the scenarios we experienced the most during my five years onboard.

INTERVIEWER: If you had to make an estimation, out of a hundred port calls, how many port calls would have incidents?

PO1: I think maybe 30% up to 40%

INTERVIEWER: And these would be issues of less than one hour or exceeding one hour?

PO1: I think about one hours or more. Especially on embarkation day. The flights had a lot of delays. You had it during the whole summertime, so that's a big impact. The also due to weather conditions, which depends on the region. In the Canary islands we had it very often. Then we also had to reschedule the ports. Sometimes also due to the captain's decision or guest satisfaction. Sometimes everything has been planned in advance, but the plan was nor very good. I remember one time in Abu Dhabi we had face checks and decided to arrive up to three hours earlier in the ports then was scheduled before so that everyone could have a smooth and early face check so that they could go ashore. So yeah, up to 40%.

INTERVIEWER: What would you say is the impact of such events?

PO1: First of all, as always on cruise ship everything is about guest satisfaction. You want to have everything smooth. Of course, the passengers only booked this cruise for this port that we now had to skip when we are now delayed. Excursions and their revenues is an issue. The excursions are a big revenue for the company. If you have to reschedule or cancel them, it has an impact. Operations that are scheduled for the port like maintenance can be big impacts as well.

INTERVIEWER: Is there anything we missed or that that you want to mention?

PO1: No, I think you covered everything.

INTERVIEWER: Thank you for the interview!

7.8.6 Interview with PO2

The interview was originally held in German. It was transcribed in English by a native German speaker. Due to the technical setup, the recording quality was low. Few passages, never longer than two seconds at a time, were inaudible and were marked accordingly.

INTERVIEWER: can you briefly describe your role onboard and especially in the coordination of port calls?

PO2: My role, for the coordination of port calls I have various employees and I supervise mainly that we come in and out of the port on time, that the agencies give us the correct information so I can use the traffic information to plan accordingly.

INTERVIEWER: Okay. (…) What would you say are major challenges or problems in the coordination of port calls?

PO2: Enabling multiple ships to arrive and depart in a certain schedule, considering they have to do maneuvers such as turning within the port, ensuring there is sufficient time to do so, keeping mind that you have to possibly slow down in case of wind and weather. So, a challenge is to make sure there is a suitable time slot where you can maneuver properly.

INTERVIEWER: Okay. What challenges do you see in the coordination with the various parties, the various actors during the port call onboard and inside and outside of the port?

PO2: That there is a binding agreement, that everybody can access to one system and that there is no interference, so that everybody can access the same information.

INTERVIEWER: what methods of communication do you use to achieve that?

PO2: At the moment Email, telephone and VHF

INTERVIEWER: Okay. And how well would you say does that work?

PO2: At the moment, I'd say around 70% good, and in 30% poorly. For example, because in those cases ships appear in port, supposedly completely unexpected, or that ships all of a sudden have to turn while berthing, even though nobody was aware of this previously, such things. Insufficient information available to all parties, which then affects the available time window.

INTERVIEWER: Okay. Who do you see responsible in such situations?

PO2: I believe that it is the port who schedules the port calls too tightly. Especially Barcelona is a nice example, where you have to coordinate with the other ships whether they'll berth portside or starboard side, especially cargo ships which always need more time for maneuvering and because of their tugs also require more space. And this has to be coordinated in a better manner, especially from the port who knows this in advance.

INTERVIEWER: (…) (introducing thesis topic and describing PortCDM) What is your first thought on this subject?

PO2: Such information exchange should be (inaudible), or in other words, that the persons (inaudible) if the ship should turn, does it have to turn, is it at arrival or departure, that should be available for all ships

INTERVIEWER: Okay. What possible problems or challenges would you see in this topic?

PO2: (…) The technical requirements. For example the limitation of available bandwidth to enable the effective and appropriate transmission of data

INTERVIEWER: (describe PCMF and time stamp concept) In which situations do you think would such information not be sufficient?

PO2: Especially during arrival, when the ship is entering the port area, if the arrival could be delayed due to port traffic, ships maneuvering. It's not only how much (inaudible) but also how long time it takes to connect the gangway, to plan accordingly what time the passengers are able to leave the ship. Such things are important. A gangway for example can take (inaudible) minutes until it is moved from one place to another. Such things should be included.

INTERVIEWER: Okay. Just a rough estimation, how many port calls do not go optimal, let's say out of 100? Before you mentioned a rate regarding communication performance of 70%... what would be the ratio for the overall performance?

PO2: I would say that two thirds of all port calls work very well (inaudible) as I said there are a lot different factors.

INTERVIEWER: All right. (presenting findings of quantitative analysis) What are your thoughts on these findings? How much do these three trends relate to your experience?

PO2: For us, the challenges are really the weather, which can also result in reroutings (inaudible) or can delay the departure, the second thing where we have a focus on are the flight connections which can result in a lot departure delays, and at arrival the main challenge is the port traffic (inaudible). These would be the three main reasons.

INTERVIEWER: Okay, interesting. Then I have checked my main points so far. Any points from your side you think we missed regarding more data connectivity in a port call

PO2: I think you could also include the ship's size, looking at the common size of ships coming to the port frequently and the maximum size of ships which call the port. Because according to this, you also become more cautious when maneuvering, no matter if you're on a cargo or passenger ship. You plan more time and a certain buffer because things can also go wrong. I think this is (inaudible) often forgotten. You also see it often here in Barcelona, big ships often close to the maximum size coming to the port. I think this will be also an issue when for example (184000 GT cruise ship) will come here, or the (126000 GT cruise ship) coming to Hamburg, going to (a narrow port area). This takes more time than the pilots usually schedule in average, and then all subsequent traffic will be delayed as well. And therefore since (inaudible) is necessary because, due to the tide, this can also prohibit whole processes, then you cannot go up the Elbe in 6 hours. Sometimes, this can have a huge effect. And this only due to the fact that somebody scheduled an average, standard time window for a maximum-size ship for this port.

INTERVIEWER: (…)

PO2: (…) And if everybody had such information in advance, you would also be able to plan accordingly, or even to create backup plans, to know, if we have delay of more than 30 minutes, we have to stay automatically 6 hours longer. Then you can also be aware of the required arrival speed to the next port.

INTERVIEWER: Thank you for the interview!

7.8.7 Interview with PP1

INTERVIEWER: Could you give us a brief introduction of yourself and your involvement in the cruise calls?

PP1: My name is (…), and I am the cruise operation manager in (interviewee's port). My responsibilities and involvement in the calls is doing the operational planning of the call. I handle all the operational services around the cruise call, for example waste handling, sewage, waste operation. Bunker I am not involved in, but I need that information so I can plan the call. It could be some conflicts with the waste barge and so on. Also, making sure that security guards are in place when a ship calls, and other kind of problems and issues that can be raised during a call. In (interviewee's port), where I am employed in the Port Authority, I am in charge of the maritime and the port operations. Then we also have (…), who is from (…), the tourist bureau in (interviewee's port). She is more responsible for the tours and the shuttle buses and so on, but since they are using our area, I am indirectly involved with that operation, and the planning of the shuttle buses. So that this the short explanation.

INTERVIEWER: What methods do you use to coordinate with as of right now?

PP1: Previous experience. We save every note we have from the ships, all the berth plans we do. We save that in our Sharepoint system, our cloud. So we have that to see how we planned something yesterday, and how we can learn from that to make it better. The communication is done by emails and telephone via the agent, so we don't speak directly with the shipping company or the ship, all information is going through the agent.

INTERVIEWER: So even during the booking procedures two years in advance it's still going via the agent?

PP1: Yeah, exactly. I think the only one that is going straight to us is (cruise company). They have their webpage, so we get a notification that they have now requested a booking in (interviewee's port), so we go into this booking program.

INTERVIEWER: So they would ask if this date is available and you will revert back?

PP1: Yeah.

INTERVIEWER: Are you satisfied with how it works?

PP1: Yeah, but now we are starting with a program, or actually (name of the program) is. It's called the cruise calender. Have you heard about this?

INTERVIEWER: No.

PP1: So it would be like a database. So once I have a vessel call reported and confirmed that she will come to (interviewee's port), and I have approved it, this will be live on this page, so other cruise companies can see that another ship will be in (interviewee's port) that date, so that allows them to see if they can make changes to berths that are available. Today we do this planning in an Excel file. I know you have seen it…

INTERVIEWER: Yeah. So you sometimes get requests but that certain date would be booked and you need to revert back. You would want more transparency?

PP1: Yeah, exactly. So if our normal dedicated cruise terminal is booked, our (…) cruise terminal is booked these days, I can go and ask (terminal operator) if they have an available slot there. Of course they don't know the plans for 2 years in advance, so it's no issue for them, so they say yeah yeah you can book it, no problem. Same goes for the ro-ro terminal, you don't have this long-term planning that we have, so they say yeah we'll fix it. Normally it's no problem. If you see it that way we can have 4 cruise ships in at the same time. So this year we will have 2 cruise ships in at the same time, and next year three ships.

INTERVIEWER: And it will also be possible for a cruise ship company to see the berth planning of their competitors?

PP1: Not the berth planning, but they can see if the berth is booked.

INTERVIEWER: Aha, yeah, allright. So they also have some level of privacy in the information they share.

PP1: So normally we just get a request from for example (cruise ship company) that we want to book the (cruise ship) for these dates in (interviewee's port), is the berth available? I will respond back and say you can go to the (secondary) cruise terminal if the (primary) terminal is booked.

INTERVIEWER: So what policy do you use, first come first served?

PP1: Yeah exactly But sometimes we get requests from cruise lines who think they are more important. Could you maybe change this berth so we can take that one etc. But as you said we have the policy that first come first served.

INTERVIEWER: What would you perceive as the major challenges with the coordination of cruise ships?

PP1: The major is to get the information I communicate to the agent back to the ship, and vice versa. So get the response from the ship. Often I feel like information gets stuck with the agent. So my point of view is that it would be much easier to communicate directly with the ship.

INTERVIEWER: So you think the agent is the bottleneck in the web of involved stakeholders?

PP1: I would not say bottleneck, but of course companies like (shipping agent) have 30 cruise calls a year, but also many tankers to handle. Their cruise department is sitting up in (different city). They only have one local representative sitting here in (interviewee's port), so all the planning is done up in (different city). Of course (different city) is a major cruise port so sometimes we are not that prioritized with the communication. Sometimes we really need to put this information.

INTERVIEWER: That's actually really interesting. (…)

PP1: It is the same with the others, like (shipping agent) who are also based in (different city). They actually drive down to (interviewee's port) when they have a cruise call. So they can't have a local representative. The same is true for (shipping agent). The only one which actually has one here is (shipping agent). So you always needs to have this in mind when you plan the ship. You need to start to plan 5-6 days in ahead so you can make sure that you have all the information maybe 2 days before the ship arrives.

INTERVIEWER: What is the crucial information that you feel is sometimes lost?

PP1: For me it would be the waste handling. How much waste they want to deliver or discharge here in (interviewee's port). Because I also have to order a third party company and notify them one day ahead. That's why we have this 24h policy were we need to have the waste figures 24h in advance. Particularly if it is a call during the weekend, then we need the information early.

INTERVIEWER: What is the impact if something goes wrong, with the waste handling or any of the issues you mentioned?

PP1: One issue can be for example with the (cruise brand) ships that have a very limited capacity of sewage onboard. So if I don't have that information early and have not been able to book that service, that is handled by the infrastructure department of the port, and on weekends we need to have people out on overtime, and we need to inform them very early about this. Sometimes it happens that I get this information on a Saturday when the ship is coming on a Sunday, then it can be a little tricky to find a guy who is willing to come out and connect the hose to the sewage system. In the case I am thinking of the ship was totally full, so it could not manage to go down to (different port), but needed to get rid of the sewage now. Since we have the policy as well…

INTERVIEWER: Yeah I was thinking about that. We have to actually handle that.

PP1: Yeah we need to, if the ship is requesting it, we need to take it. That can be an issue sometimes. Now we are always booking these guys in advance as a lesson learnt. It's always better to have one guy standing on the key that can connect to the sewage system. If the ship does not want to discharge something we just say ok, you can go home., instead of calling them on Saturday night and say that you need to be down on the dock on Sunday morning.

INTERVIEWER: That would result in additional costs, 4h of additional overtime?

PP1: For us it would be an extra cost, yes.

INTERVIEWER: 4h of overtime every time you call a guy down, even if he is not connecting anything. 3 or 4. Stepping back from the waste handling scenario now. How many port calls, in your rough estimation out of 100, do not go as planned?

PP1: I would say 1 or 2 calls. Most of the ships have been here many times, so they know the drill, how it works. I should not mention any specific company, but it can be some companies with ships coming from an (Mediterranean) brand… They are not planning so much ahead.

INTERVIEWER: Can it have something do with (brand) exchanging passengers in many ports as well?

PP1: Yes, exactly.

INTERVIEWER: We have heard from other people we have been talking to that they have a partial passenger exchange in multiple ports instead of kicking them all out in one port and taking on new ones.

PP1: We have not had so many calls from (brand) in the past, but it is increasing now in coming years, so maybe we will experience issues then.

INTERVIEWER: I you could change something to improve the communication chain, what would it be?

PP1: I think, if I refer to STM, making all the information available. That is a major topic with STM, so everybody can check if things are done and everyone has confirmed that things will take place at a certain time. If we go back to services again, it happens often that ships say that they want to deliver waste on arrival, but then on the actual arrival we are there for 1-2h, waiting for the guys to come down. So that's something we have learnt, that if they say on arrival, we will be there one hour later, because it never happens on arrival. Particularly if they arrive at 7 or 8 am, we know for a fact that the guys are eating breakfast then, so it's not time to be there. Yeah, just to make all the information around the port call available for everyone, that would be so helpful. Also to have this clear structure of who is doing what. Because I often get questions about security, but I am not handling security in that operational way, that is instead done by (company) security. Lots of information comes to me, but I just forward it to the responsible guys, for example to (company)for security or to (colleague) for tourism. But I understand it from a shipping company perspective. It is always nice to have one local person, and he can in turn distribute out the information that they are sending.

INTERVIEWER: As a port, what is the most important communication path, is it between you and the ship, or you and the agent? You said everything is mainly handled via the agent.

PP1: Yeah exactly, but I think it is between me and the ship. Because we know how we want to have it, and I think the ship has a better perspective in some views, for example gangways. Sometimes I might have an idea, that let's say we could connect the gangway a certain way based on your shell door plan. Then I need to forward this information to the ship and ask if you want to use this gangway or another gangway. Sometimes they have gangways they can use on their own, and sometimes they have shore-based gangways. That kind of information is much easier if we communicate with each other, me and the ship. To make sure that we are talking the same language.

INTERVIEWER: (description of thesis topic) Where do you think enhanced data sharing would increase the efficiency in your operation?

PP1: I think a lot of the uncertainties surrounding the cruise call can be made a lot better if we share all the information and everybody is making the information available. Then we don't need to sit and guess. From my perspective it sometimes is a lot of guessing, especially when new ships come to (interviewee's port), because we don't know how they look, where the shell doors are located, which kind of gangways we connect to them, where the waste handling hatch is located, the sewage hatch, how we can fit them on the key to make sure that we don't need to put long hoses on the key, how can we make it more comfortable for the passengers so we don't mix them with waste handling and so on. All this information can be much better if we have a common communication and a common planning platform.

INTERVIEWER: You are familiar with PortCDM which is a focal point of our thesis, the port call message format (explain PCMF). Is there any situation you could think of where you would need more information?

PP1: I think it could maybe be good with some… for example shell door plans, updated shell door plans. It is a real mess to get from particularly old ships. They might have shell door plans from 15 years back, but we don't know what might have happened during dry docks throughout the year, they can have relocated the shell doors. The same is true for sister ships, we can get the information that two ships are sister ships and that they have the same shell door plans. But then we are standing there on the key and no… this is not the same ship. So a common database where everyone could access and update would be good. We are doing it now for example in the cruise Baltic platform, destination baltikum. Here we constantly update information about the port, for example key length, water depth, any infrastructure issues or reinforcement programs on the keys that could impact the cruise ships. So the cruise lines could easily come in and check this platform. It would be very appreciated if we could do the same with the cruise ships. Because in my point of view they want a lot of information from us as a port, but is really tricky to get information from them. Every year we get these port questionnaires sent out from the cruise lines. They just mass send them out to us, and we can't just copy paste the previous one because they always change something. So we have to reinvent the wheel every time.

INTERVIEWER: Massive annoyance.

PP1: Yeah you have so many documents on the berths, but you never know which is the most updated one. If you have an electronic database it is easy to know which is the updated one and you can timestamp and datestamp it to know when it was last updated.

INTERVIEWER: Interesting point. When we talk about the operational side during the port call itself. PortCDM, or in general these information sharing concepts, they also aims at exchanging time stamp information in real time. So for example in case of scheduled deviation: shore excursions expected to be

back at the ship at a certain time, ETD planned for 7 o'clock. How much would these real time related timestamps bring to you?

PP1: I think that would be really helpful for me. Especially because Destination (interviewee's port), the tourism responsible are not always there on the quay. Because I am the only one who is actually on the key, and I sometimes don't have a clue where they are or when they are departing or when they are coming back, where they are dropping off the passengers, where they are going etc. So I am trying to get that information ahead so I can answer those questions, but that is just because of my curiosity. So if we could also have that in a database so everybody knows where the buses are going and they are dropping passengers off it would be good. Also from an marketing perspective when we visit the cruise line. Then we can have this information that you are normally doing these tours, maybe you could think about this, because you are missing this place etc. So you can also use it when you are doing statistics and analyses. Because now we are doing it for ourselves, going into their webpages and look at what they are doing, then compare with other cruise lines.

INTERVIEWER: Why do you do that, and why do you collect that information?

PP1: Just to have a nice conversation when we are meeting the cruise lines on speed meetings and marketing events.

INTERVIEWER: So also a way to improve their satisfaction?

PP1: Yeah exactly.

INTERVIEWER: Oh interesting.

PP1: So I think it could be very useful for us.

INTERVIEWER: Do you see any other benchmarking potentials for concepts like this? You have more access to data.

PP1: It's always nice to have data. Particularly when you do statistics and try to analyze what they are doing in (interviewee's port), so it could be very interesting to know where the buses are going, what are the most popular tours and so on.

INTERVIEWER: So you think that as wide as possible of an extend with the data sharing would also mean as good as possible? Do you see any limitation with that, perhaps in regard to sensitive information that should only be distributed to a certain few?

PP1: No I don't think it is a problem, at least not talking about shore excursions. It not any classified information. In (interviewee's port) we have (3 shore excursion agencies) that are selling the tours to the cruise lines. You can always get this information from someone if you want to have it. But now you need to chase this information. It is of course time consuming. Everybody does not have time to make a nice excel and state where they are going, how many people are on the buses, how many buses etc. It is a lot of guessing. Particularly when we have the big cruise ships. It can be difficult to plan for example ships in the (specific berth). How big space needs to be allocated to the buses. We will have 20-50 buses, and you could say ok yeah, that is a pretty wide span. So if we could have this information, like it will be 50 buses, or we have booked this many buses it would be much easier for us to plan how big area is needed at the key.

INTERVIEWER: Before you also mentioned this planning tool to schedule the berth availability between different ports and cruise lines. What value do you see in a data sharing concept, for example PortCDM, for such application? Having this long term planning between ports and shipping companies.

PP1: I think in general we can make this whole… not only for (interviewee's port) but the whole itinerary for the cruise line much more effective. We can also give them the best options. Of course (specific berth) and the ro-ro terminals are not the best places to have a cruise ship. If we can make this information early available, they can rethink and route the ship to (interviewee's port) on other dates instead and for example switch dates between (location) and (interviewee's port), to make it better for everyone.

INTERVIEWER: Improve guest satisfaction. (explanation about our conversation with previous interviewees about documentation handling, especially in relation to immigration and customs) Do you see any potential from the port perspective as well with for instance integration with national single windows? More of an inclusion.

PP1: I don't see those immigration lists, so I don't have those opinions. Some agents are working fully in the MSW, and some agents are still sending us those old waste declarations. So we can make it much easier if we have one shared platform. Maybe I can also log into this platform during an early stage and check if they have filled in the information, and if not give a push-notice to them to get it done because we need to have this information to make the best of the call.

INTERVIEWER: (introducing app used by PP3) is it something you could benefit from?

PP1: Yeah it is really good. I am looking into it as well. Now I have this email list to send out updates, and I have to go and manually remove people from it who don't need to be in the loop. Also when a ship change times with just an hour or so, I need to do the same and go through those email lists, which people needs this information. If I had an app instead, that would be much much more helpful.

INTERVIEWER: So you could view it as a competitive advantage having more data sharing capabilities and maturity?

PP1: Yeah that's true. But it also comes down to that we in (interviewee's port) have some about 50-60 cruise calls. That's only one percent of the total ship movements here, so we are a very small unit here. Of course if the cruise calls raise, we can start to discuss these things, because it would be more beneficial for all.

INTERVIEWER: Yeah. One idea with PortCDM is to introduce one standard that can be used by different actors, so the aim would to presumably be to have a low barrier to implementation. It could be helpful aswell. So you would need a connector to read the S-211 data, that would put you at PortCDM maturity level 1. That would be enough for a small port. (…)

PP1: Yeah exactly. I would be happy is the major ports will take the lead, and then we just go into these projects. Because of course we don't have the funding to do this. So I think right now everybody is waiting for that fist port to take the first step.

INTERVIEWER: (Cargo industry to be change makers, cruise industry to utilize a refined concept)

PP1: Yeah, I think there are around 85 different cruise ships that are moving up here. So it is not so many. Many are also sister ships. If you know one of them you know the other, but of course there always is uncertainty if she really is a sister ship.

INTERVIEWER: (Introduction of quantitative analysis of cruise ship calls and our findings) What are your thought about this? How often do you think these types of events occur, and if so, how much communication do they require?

PP1: For example rerouting, I have never experienced that. Last year we had two extra calls though. Someone at the shipping line had not done their calculations correctly, they would not manage to make the requested speed, so they had to add a port instead. Luckily for us that was (interviewee's port).

Delays at arrivals… as I mentioned last time we spoke, the ships are often coming to early to the port. Of course that is good from our point of view. Delays departure has never happened here, cruise ships are prio number one, so the always have the pilots in place.

INTERVIEWER: Exactly. If there is going to be a delay, it is allocated elsewhere, to a Tanker in (location) for example.

PP1: Yeah exactly. So this is not a written rule or regulation, but simply what we do. We know that the cruise companies don't want to be delayed, so they have their pilots onboard half an hour or fifteen minutes early so they have times for their pre departure checklists and so on. What I can think about right now, is that we are building all around (interviewee's port), so we might experience some delays from shore excursions. We don't know right now how this will affect us, but we have dialogues with the bus companies, the tour operators and the city and traffic planners in (interviewee's port), to see how we can minimize this risk. Here we try to give the city planners all the information. Sometimes when we have more than one cruise ship in (interviewee's port) at the same time we will have some 50-60 buses driving around the city, so as I said, we are not experiencing any delayed shore excursions, but we will see how this year goes. We are monitoring this closely to see if we can do something effective or communicate this early to tour operators, that this road is closed and you can go this way instead.

INTERVIEWER: It's a really interesting aspect.

PP1: We try to work very proactively. We have two debriefing meetings now about the traffic situation in the time, and how it will affect the tour buses and so on.

INTERVIEWER: Building on the smart city concept.

PP1: Yeah we don't want any bad publicity. You start to hear about cities now where there are problems and complaints about the cruise traffic.

INTERVIEWER: What are your concerns about such potential delays? What would be the implications?

PP1: I think more on the guest satisfaction side. That they have a bad experience and only sit in buses without being able to see the things they want to tick off their lists. We always try to have a dialogue here so that the buses don't get stuck here.

INTERVIEWER: Reflection on what was discussed today, did we miss anything that should be covered?

PP1: (General questions about the PortCDM concepts)

INTERVIEWER For you, being in the middle of (closeby port) and (another closeby port), it would already be a huge benefit to have a connection with these two ports

PP1: Exactly, I could just get the information like the ship has just sailed from (closeby port) as planned, and I would know that she will arrive in (interviewee's port) as planned. Today I log into the pilot booking scheme and see ok, she is booked for 06:00, so you always need to chase the information. It would be so good with a common platform.

INTERVIEWER Thank you for the interview!

7.8.8 Interview with PP2

INTERVIEWER: First of all, we already had some discussion previously about this topic so we might pick up on some things we already talked about. We try to avoid it. Right now, we are doing interviews with different parties, so we try to do some questions which are more general

PP2: Yes, and also in the settings you have to know that I am the IT-guy, let's say the collaborative idea guy who facilitates and develop IT systems. I facilitate more than I use them.

INTERVIEWER: That's perfectly fine. That's a (...) Very interesting angle to have. Just to get started could you briefly describe your role in the cruise ship port call in your position?

PP2: Yes, my role in the port called as such is limited, but we need to have the systems up and running, and I see how the connections to service providers are missing or can have different qualities. I think we see that when a port call is approaching it's already too late from the IT perspective to do anything. It's more to be on the preventive side, the issues with the connecting, having many connectors, supposed to have one connector like PortCDM could be. Integrations have a big impact when we have cruise call or a port call. We have a single maritime window where I can get all my information and subscribe to what I need to have. And you will have the issues of big data flows and the issues of filtering. From that IT side when you have a cruise call approaching and it it's already too late to do anything with the IT part of it. Through the EU project and at least I've seen that it will benefit the IT and the integrations to have only one single point of entry and one single point of exit, so to speak, even if you have many exits, and I also talk about exits seen from the port side. And of course, all the actors will have their own exits and two-way communication with the API talking to another API which is (...) The time, this is good. So seen from my point of view I'd say that when it comes to port calls I see the benefits of having one contact point instead of how it's now with a lot of usage of telephones and a lot of emails going, so I think that this path it's also important that you see clear if you have any red states, yellow and if it's all green it should be clear. Plus, I could analyze it and of course you have the issues with quality and its security, and you could always have the risk of being breached, hacked and where everything seems to be green, send the people in the wrong direction for example. So, you always will need the facilitator as far as I can see to at least have the physical observer and controller on the spot when the ship comes. This in addition to be there physically and have the it up in front, he needs to check that there is no conflict between what he sees and what he's supposed to see. So yeah, that's how I interpret how it should be and how we also saw in the cases where we had the test bed where we validated. Of course, coming back to the quality, in the beginning, during the first testbed we had major issues. The quality was low, but that improved. But still I would have wished for another year to test everything, having additional connectors. So seen from a port side, the lack of connectors was probably the thing we saw as failing or at least as issue regarding how much we could verify and validate

INTERVIEWER: When you talk about the lack of connectors, what kind of connectors do you mean?

PP2: I mean machine to machine (M2M) connectors to let's call it management systems and each of the stakeholders' environments where they plan and do their things. We have of course the manual ones but where you have a lot of fluctuation with a lot of, let's call it turnaround, because you have maritime coordinators, they have rotational shifts, so they have, it would be difficult to keep up the pressure for a long time, because you would have to change information so often. And also, when it comes to the services it can only reach as many, but you give the (inaudible). I think a lack of training and automatic integration, because if you have automatic integrations, then the user may use their own system. And that would be preferable since they would know it already, and it would be, having more states, and the state of the quality would be more correct, because you have it in your own system. Of course, you have the issue of what you put in the system, you put in only the estimates or also the actual? If it is only the estimates then you need a handyman solution, we have a handyman solution on the mobile phone where you push the button start and stop. And then you get at least the start and stop time and then hopefully it should result in the right state so is that it is for example the mooring operation or the water operation or other services. You have the issue with what can you get and what should you have. There could be a gap even if you build the connectors. We are not overdoing it and not making it too complicated and too expensive in quality and information for service providers. You have to take that into aspect as well. What do you have with a lot of good connectors have the issue of quality as well?

INTERVIEWER: interesting

PP2: and of course, the connectors will then connect to the PortCDM database so when I talk about multiple connectors now it's also seen from each person or company's view it's only one connector they have to integrate with

INTERVIEWER: Yeah. Interesting. Talking about how it is nowadays, we talked a lot about how it can be improved, but talking about nowadays, where do you see the potentials or the areas which can benefit from such an enhanced data sharing capability?

PP2: I'd say of course, when I see the value chain, the value chain in the sea traffic area between the ports, but you also have the value chain going from the terminal to the hinterland. And I think you have many people working in ports, and they have the need for the interaction with the ship and service providers as well. But I think the goods' owners should see the benefits they, I wouldn't say they're allowed to, but they should at least have the possibility to look into this, because I think its goods' owner who sets the premises and rules for settings for the cargo transportation. And I think cargo transportation can be relatively flexible, and cargo can be a lot of things, everything from transporting persons to cars to goods in the cars or in containers, so I think beyond this quay side action of just what's on the top side of the quay, you should probably share this data with the hinterland actors in a much more efficient way than we do it now. So that's the potential I see as big because we'll have a lot of interaction that affects production facilities, storage areas, that are not in the port side area, but are around it or far away

INTERVIEWER: How do you see the potential in relation to the cruise ship calls, without the cargo aspect?

PP2: For the cruise ship calls, it's of course the passengers which are the cargo which the cruise ships deliver to the communities, because in the communities you have not only restaurants but can have also guided tours, sightseeing objects which you can visit on your own. You have public transportation, how can you interact with them in a good way, regarding environmental or safety issues. So I think to get just-in-time (operation) to work in the value chain so we need to look not only what happens on the quay side and on the first 100 meters from the quay side, but we should move it to the warehouses, goods' owners, so that they can track their goods, do benchmarking, what they can't do just now. So, then they can use their knowledge to get even better operations or they can choose other routes.

INTERVIEWER: That's a really interesting perspective to use such a system or concept for benchmarking and see where improvements can be, not only for the cruise industry but also for providers.

PP2: I think also you can save the environment and be sustainable if you just know more than you do right now. And such a system will give you more information how to optimize, how to not drive and get out empty-handed, or that anybody has to wait. If you have waiting times, it will not be "lean". If you have wasted time, you can never get back, money you can get back, but time is always lost. If you have buses waiting with running engines, that's a waste of time.

INTERVIEWER: And unnecessary pollution

PP2: Then of course, throughout the whole value and supply chain, there must be interactions you can shift on the sea side, which you can do earlier or later, for example green steaming or discuss right steaming. Sometimes it's more efficient to 5 knots more than doing the same as usual business, because then you don't have the issues of congestion at the port. You can do the time slots better, for the truck drivers, busses, guided tours, if you know that they come 30 min earlier, you need to know that as well on the land side. But with the timestamps, you can get a lot of information, but you won't get detailed information before you get information from the cargo owners.

INTERVIEWER: You mentioned also benchmarking. How is that done at the moment?

PP2: I'd say from the port's side it's very limited what we can manage to do ourselves and what the others can pick up what we are doing. So, from the port's side I'd say what we do now with the KPS's, there PortCDM could bring more, it's very difficult to benchmark each port. Some ports are very similar, some

different, so you need to be aware of that. So, you can't benchmark or compare two terminals with different operation

INTERVIEWER: What potential do you see in improving your benchmarking capability?

PP2: The improvements will not be only that you have the historical kpis but also the real-time data. So, in a TQM perspective, it means that you can have either upper or lower control limits. And when you breach them, e.g. Come too early or late, or if there's a tendency that if you never get in before this time, an alarm goes off and you can rearrange the systems. So, it's a real-time benchmarking and a surveillance of your operations, and you can benchmark it towards what you were planning. So I think, regarding benchmarking, the benefits will be there if you use it as a kind of open data and we want to show that we are very good at something it's open data. If we want to protect how bad, we are because we think we're much worse than the next port and we'll hold back. And then the next port who opens up has the benefit of being benchmarked, and the ones who hide will probably lose in the long term the customer trust and we could risk the ones grapping the PortCDM aspect first and having open data will be the ones getting more jobs, more cargo, more cruise passengers. Because we can openly show how good we are, how bad we are. But until everybody does it, there should be in the beginning no problem because you can hopefully be the first one in and be there in the leading position. Then the other ports come, you look at their kpis and then you can try to improve your own. So, you should think in an open data mindset.

INTERVIEWER: So, if I understand you correctly, to paraphrase, would you say that adopting such data sharing capability both in the internal system and against outside parties would bring economic advantage?

PP2: Yes, it's like the head-tail curve - you have many actors coming into the market, you will have fewer coming out in the long run. Because they go bankrupt, they cannot manage it, and it's even more difficult the longer the time is to penetrate the market. So, if you don't turn on it fast enough, you miss the head part and the tail part will be impossible to penetrate, so you'll have lots of issues

INTERVIEWER: Very interesting. Do you think that having an information sharing maturity would be a competitive advantage for your port?

PP2: Well, if the port can be certified, the customer can expect certain things to happen. Certain things will be open for him to see, like the efficiency, the services. Also, how many delays they have.

INTERVIEWER: More transparency

PP2: Transparency of course can be frightening but can be also an opportunity. With open data it you can also contributed to the municipality in a better way. So, it's not only the cargo owners perspective but it's getting also be other service providers gaining from this. Not only is the cargo but also restaurants for example in the case of a cruise industry even the cab drivers or taxis should have an interest in knowing how many passengers are coming, maybe they should go to the city center or to the airport. When he can collaborate with his colleagues like other taxi drivers they can see if there are enough taxes at the airport, so they don't need to stay at the airport. But if there is some kind of counting system like internet of things connect to it in addition to this, you can make some kind of prediction and try to optimize it in the cab driver's working day.

INTERVIEWER: Yes, very interesting. You yourself have been involved in the (PortCDM testbed). PortCDM at the moment does not include actors like cab drivers are restaurants. Where do you see the role of PortCDM in such a development?

PP2: Just now the smart city concept is growing at a rate of approximately 20% of each year. So, you need to interact with a smart city concept. I don't think that towards should have a standalone solution, but I think the ports should have collaboration with many parties. Smart city will have their own data set their own database. There should be an own layer within such database where were you use the PortCDM to get information out of the maritime sector to the smart city. So, I think in the future there will be a lot of integration between PortCDM and smart city cdm. And I talked with (researcher in PortCDM) and said we

can use the same concept for smart city cdm aspects. (...) Here I c benefits for the municipality and the city. You can draw this also to the ferries. But if you have a hospital waiting for something from the ship like goods or a passenger then it would be really nice to know where is this right now? Tracking, not persons but at least cargo, will also be a thing that will be more and more important in the future. As I said, the smart city concept is growing at 20% rate each year and PortCDM it's growing from I don't know 0 to 100 hopefully in one year. But I think they need to make each other good. You cannot only have the timestamps in the smart city concept, you need some tracking of good's cargo or cars or public transportation (...).

INTERVIEWER: Before you also mentioned the conductivity in the cruise ship operation. Do you think that that would connect in the smart city concept as well?

PP2: Of course. Everything from giving the passengers the right information about public transport accurate information, the quality should be good enough, the cruise companies like to sell day trips and they should be allowed to do that but seen from an environmental perspective perhaps it is better to have them walking around. They can get a small map on their mobile phone. And the guides companies can provide sound and charge $1 for being at this sightseeing spot and giving sound and text. These are aspects of let's call it green tourism. That goes also in the business side of the cruise company, but I think they should be aware off the tendency. And municipalities want to cut emissions by 80% until 2030, that is one of the UN sustainability goals. It is difficult to say what we can do just now but more is going in the direction of self service. And you can do self-service in real-time environment.

INTERVIEWER: How much is that an issue for you working in the port or the port itself, the environmental impact of the cargo sorry cruise operation?

PP2: It impact us in an HSE perspective. Health security and environment. Going from the days where we had almost no tourists and no cruise ship going to 10,000 passengers going in the streets, going to the port in buses, those are constraints on all operation. So, we cannot do waist operation after the ship has arrived. We can but there are some issues where we have to secure the entrances and keep the people away and then we need more manning to do that. So it has an impact on our security to employ people in the ports, it has an environmental impact with more cars more buses in the ports, so you have the consequence of cars and buses going to and from the city center (...) And we also have the issue with the inhabitants who feel the cruise ships are taking over similar to Mallorca. So, there are constraints that follow being a very popular cruise ship port.

INTERVIEWER: Tying back into the number of passengers, one request we got from agents we talked to and also onboard personnel like pursers was that a big part of their job is filling out the (maritime single window/document clearance processes). How do you see a standard or a concept like PortCDM going towards a unified way of working with single windows? Maybe you don't need to fill out a single excel worksheet for the next country?

PP2: I talked with (...) who told me last week that it is the ship owners who try to initiate is EU single windows. And it has always been our ports interest to support a national single window but if we can get a European single window it will be even better. We should raise our eyes and look ahead on an international level, but EU is good enough for now. We need to take the small steps. And I think that PortCDM should be a part of this new European single window. (...) I think it is very important to use the standards that exist in order to make it even easier 4-port management or planning systems to integrate into the operation. But you still need as far as I know a center and the European single sign-on window could act as center, but it is going to be really big data. It's going to be a huge server park with a lot of servers and stored data where you will have a lot of actors trying to integrate. So, who is going to handle this much of integration? And you will need to build up a new European (...) Coastline administration. And I think that could go against open market (…). It's the issue where should the private have the responsibility and where the public (...). Some issues of very national in public and some aspects are more private (...). PortCDM for example could integrate more in the hinterland, national single window or European single window should be more towards the ship and land operations. Ship industry on the seaside I am a bit uncertain. The European union needs to fund it before we do anything. They should think about integration and not about displaying. So,

the private actors should do the display the data in the database and you could be the ones filtering, they should be the experts and those two things, ui and ux, user interface and user experience for example. But maybe they don't have that type of expertise.

INTERVIEWER: Very interesting field and will be excited to see what happens. We have just a few questions from our side left, going more in the operational side. Last time we talked we talked about how much of the operation is also including the agents who is doing the communication between ships and ports. How do you think such systems would affect the operation?

PP2: I think there are two aspects. One of them is like I said the quality and the just in time, with that it will have a better flow, and the second is a business case where the agent will probably have less work, only providing the service of being the guaranteed, guaranteeing the payment to the port or other national actors in each country. If they are going to be protective, I think the ships are going directly to the port and ask what services you can provide directly through PortCDM. This will have a negative effect and later on you might just have one agent per country because the rest will not earn enough to keep it up.

INTERVIEWER: All right. (...)

PP2: It can go quick in a bad direction for the agent if they don't open up and provide services in a PortCDM environment. But of course, everything is about money here so if the agent says I can do it for half of the price of the port, then of course we don't need PortCDM. But for benchmarking you do.

INTERVIEWER: Yes, that's an important factor for sure. Another thing we talked about last time was we were talking about what issues you have in the daily operation. And I know it's not directly in your field, but we talked about one of the issues ships being too early rather than being too late.

PP2: You are absolutely correct. That does not affect me on the IT side but its effects the processes and it effects the costs because we have to be earlier on the key side, the management and the linesman and the port authority. So, we want to be sure we don't have an issue with shipped being too early, it's the cruise ships in particular coming in (from a certain route). On the IT sides the issue with early arriving ships would not be an issue as soon as you have a system of handling it, then it's more operational issues. (...) From the IT perspective it is not critical but for operations of course it would help the actors and the integration and give a better predictability (...) and what we are discussing right now is an AIS system (...). What we are discussing in the port is what could be an early warning system for the port. The early warning system can be through an AIS system, when you have a ship which crosses a line or it can be a line outside of the port, and if you have a ship you want to follow you make a mark, I want to have a SMS or something or it could even go in the PortCDM, you can have an early warning message coming just in time. (...) And we had a just-in- time project last autumn with ai. If you can combine the historical data of cruise vessels coming in with the same direction and same speed you can predict what the ETA is going to be.

INTERVIEWER: Independent from the information in the AIS?

PP2: Yes, with the information from the AIS, you have an 85% accuracy of the AI guessing the ETA correctly, where the ATA in the port is almost identical. You can know 6 hours in advance if it is a pretty simple route when it is going to come into the port (...). And then you can use ai and deep learning and connect it directly to PortCDM, the estimated actual so to speak, and then you can improve the operations and send out your people earlier on a short notice because sometimes they don't and that is because of inaccuracy, and there is a risk of major error when you talk to your linesman and ask them to come one hour earlier. I think from an IT perspective this is going to be a continuous improvement process where you can do multiple lines in connection with artificial intelligence and this in turn will benefit all actors in the port. I think it is about small adjustments. Imagine you have a cone the smaller the cone gets the more accurate it will become and if a ship crosses a line in the cone have an alarm.

INTERVIEWER: Yes, and before we also talked about the communication between ports and other ports. I reckon that would be just complimentary.

PP2: Yes, definitely complimentary because there can be issues which you can see really early doing port to port collaboration that could come even before the ship, sometimes the port knows more than the ship for example.

INTERVIEWER: How much communication do you have with other ports nowadays?

PP2: It is very limited

INTERVIEWER: Do you see any need for it, a niche for it that could be beneficial, a timestamp communication?

PP2: Yes, I think cargo operations, if you have a large container coming from (other port) and it is 12 hours late then you can have another ship coming to the quay instead. (...)

INTERVIEWER: One thing I am wondering- we are talking about these solutions for example port to port communication or integration with the hinterland operators and some of these might be more beneficial for cargo ships. How much efforts do you think from your technical perspective would it take to transfer these systems to a cruise ship environment?

PP2: After 10 years in the port (...) We have rough estimates, for each partner in the integration setup it is going to cost approximately 8000 euros (...) to integrate. Then later you have the costs if one of them wants to change something which is not standardized of course. So, integrating is difficult if you don't have standards. If you have a PortCDM environment, either it's the EU single window or the "local standard" in (...), it will cost the port 8000 it would cost the ship 8000, and the thing in the middle would always be the same. So, I would not pay $8,000 for the next one to integrate. So, there is a lot of money you can save integrating into a common system. And I think most people don't know how much benefits do they could get, cause if you have five integrations, every second year do you need major changes to your system and trying and failing is part of it, then you can at least double the amount used in a one-time integration to a national single window that has PortCDM in it.

INTERVIEWER: Thank you for the interview!

7.8.9 Interview with PP3

INTERVIEWER: Could you briefly describe your scope of work and involvement in cruise ship port calls?

PP3: Our scope is that we get an agent if a cruise vessel can come a certain day and we have a berth for them, we then answer yes, we do upon which they revert and says yes that's fine. Then we book in our booking system, that specific call. That's what we actually do around the call. That's what we are involved in, booking the call.

INTERVIEWER: And the time horizons are some years in advance usually?

PP3: Yes I would say about two years ahead or more. So at least two years ahead. We are more or less finished with the 2020 bookings. There are still coming in requests for berths, but we know more or less how the situation in 2020 will look today.

INTERVIEWER: Okay, good. When you have a ship approaching, what systems and concepts do you use to coordinate the port call?

PP3: Systems… we follow them on the AIS in the traffic control here in (interviewee's port). We also have the cruise app which all our employees can use and see what time the vessel will arrive. But in final in in real time we will use the AIS system or marinetraffic to get updates from there to see where the vessel is.

INTERVIEWER: Okay. How well do you think that works, lets say on a scale from one to ten?

PP3: Four us it works… I should say 10.

INTERVIEWER: Oh perfect. So regarding the communication involved in the port call, what would you say is the bottleneck, if any?

PP3: Bottleneck… one can be the weather situation so that the vessels can't go through the archipelago, another one can be if we have a lot of call a certain day there can be a lack of pilots. I would say those are the main issues.

INTERVIEWER: Okay, so weather issues and lack of pilots?

PP3: Yeah I should say so.

INTERVIEWER: Are there any major challenges you think of with the communication between all the involved actors?

PP3: The major challenge is that all get the correct time schedule, so that they have the actual arrival time and time for departure. But we've had quite good communication with the companies handling the linesmen. It's actually two companies we use, or rather the agents use. So we have quite good communication and a good dialogue with them, so I shouldn't say it's a big issue anymore. It could have been. In the past we had the linesmen here in the port, by ourselves historically. A few years ago we outsourced it to private companies.

INTERVIEWER: If any issues arise in the port call, how would the procedures loo like to handle those. Who would be the decision-maker, and where could you see bottlenecks in the communication?

PP3: Everything will go through our port and traffic control center here in the port. If anyone needs to take a decision about a vessel coming in then one of our harbour mates has to take a decision, and there will be a discussion here within, and with the cruise vessel. But the main discussion and decisions are handled in the first stage by the traffic control that we have.

INTERVIEWER: I remember the last time we talked about operational issues for example because of for example the weather which require rerouting. I remember you saying this was no major issue for you. Is that correct?

PP3: Hmm… major issue, it is of course an issue to reroute. If it is not possible to take a vessel into (interviewee's port) because of the wind, we have to look at rerouting it down to our harbour in (closeby port) where we have cruise calls as well. That will be quite short time to take that decision and get all the people down there. So there is a challenge to handle that, and get all the information out to everyone and the companies that handle the tours of the vessels as well. So they know where go and pick up the cruise passengers. But we have a little bit better situation this year because this year we are going to handle the mooring by ourselves with our own mooring vessels down in (closeby port). Previous years we had a separate company taking care of that, and that company maybe had other work and didn't have boats available on that unplanned day, so it could be a situation. That we are now handling by our own hands for this season. That has opened up a little bit of more flexibility for us.

INTERVIEWER: From the top of your head, if you had to give a very rough guess, how often does it happen that rerouting or really major delays happen? Lets say from 100 port calls.

PP3: Oh… maybe one from one hundred. Last year we had maybe one call from 268 that we rerouted down to (closeby port) from (interviewee's port). But we also had a few situations with quite windy weather where we had to cancel maybe two calls or something like that depending on the wind. But they cancelled (interviewee's port) as a call and continued to the next port of call.

INTERVIEWER: Okay, interesting. In a situation like that, where you have to reroute, do you see a real benefit for enhanced data sharing and more transparency for all actors?

PP3: Yeah. I can't say no. Of course if you have some common system it would be good, but we have a quite good system with the people involved in the call. It's the traffic control together with the harbour mates that handle that one and are responsible for that specific call. But yeah of course, in that case it could be helpful.

INTERVIEWER: Do you use any kind of benchmarking within your current system, the app, so you can pinpoint any faults to improve?

PP3: We always look over the systems and benchmark, but for right now I think we have a quite good system that everyone is satisfied with, so I can't say we have any big issues or big problems with the way we are handling cruise calls today.

INTERVIEWER: Okay, that's good to hear. Going out of the rerouting scenario and in to a more general sense. You know we are writing about data sharing and focusing on PortCDM. But without focusing on rerouting or PortCDM, where do you see that general enhanced data sharing and collaboration between the actors in the port could bring value for your operation?

PP3: Good question, good question, silence in (interviewee's port) (laughs).

INTERVIEWER: Oh no worries, take your time. It's a tough one.

PP3: I would say that we have a good system. I would have to think about what this get us that we don't have today. But I actually can't say that we are lacking some information or something. We are following the pilot site, what time the pilots are booked and what time they are arriving at the pilot position in the (port area). We are following it on our AIS, and we have it in our traffic control. I can't say… but that are because we are using the systems we are using today. Everything could be like this PortCDM now… it could be an advantage, one system that can handle everything, and we can get out all information from, so of course yeah.

INTERVIEWER: So if I understood you right, the actors in your current system are all attached rather directly to the port. What value would you see in including actors outside that organisation, for example the ships, other ports, service providers within the city or anyone else so to speak?

PP3: It depends on what information you want. But cruise calls are so pre planned in detail from the beginning, and it is very seldom that the plan will change and you have some changes in schedule or something like that. It is only the weather that can change that or if you get any technical problems onboard the vessel itself. But other than that it is very scheduled. If you compare that to a cargo vessel that are on a route within Europe for example and has several days at sea and can be more or less affected by the weather, the wind and the waves and things like that. I think it's more advantages there, in that kind of traffic.

INTERVIEWER: I am looking into the written notes from our last discussion and I think you concluded that for now you have all the sufficient tools needed to make the operations very smooth and efficient, but you would consider utilizing concepts like PortCDM if they were more developed and perhaps already adapted in the cargo industry. Would you say that was a correct assessment?

PP3: Yeah it should be a correct assessment, yes.

INTERVIEWER: We also described the port call message format last time we spoke, for example (description of PCMF). You said you didn't think of any situation you would find it sufficient. Perhaps you have reconsidered it that a bit?

PP3: No I think I would make the same statement today as well.

INTERVIEWER: We have been in contact with both agents and cruise lines, for instance a first purser. They are handling a lot of documentation on board in relation to immigration and customs. They see that kind of documentation as the most time consuming. So do you think that integration to the national single window could be a long term benefit even for the ports, if you have some documentation process you have with cruise ships that is very time consuming. What would it be in that case?

PP3: Of course that should be a benefit for sure. Even for us regarding documentation, because it is a lot. They have to provide documentation to us for like waste handling, 24h notification and so on. So it should be an advantage, yeah.

INTERVIEWER: Another statement we heard from both the people working on the ship and the shipping companies was that in case of schedule deviation, a lot of the efficiency in rescheduling depends on the availability of the agent. What would you think about that?

PP3: Allright, that is a question about the agents… I think the agents that we work with in (interviewee's port) are more or less working 24/7 during the season, so I can't see that there should be any big issues, but that is more of a question for the agents I assume.

INTERVIEWER: Yeah, of course.

PP3: I have been here for one cruise season now so I haven't seen… I shouldn't say that there have been any problems.

INTERVIEWER: Interesting to have your perspective on that as well. (Introduction of quantitative analysis findings and the three common events that could benefit from enhanced data sharing capabilities) What are your thoughts?

PP3: That you are correct!

INTERVIEWER: Nice to hear.

PP3: That's a correct analysis (laughs)

INTERVIEWER: And you also mentioned briefly before that events like rerouting or delays do not happen very often in your port.

PP3: No, I should say it is very seldom we have that situation. If so then mostly because of the wind. Exceeding the vessel's permission for sailing the archipelago.

INTERVIEWER: What is the limit for sailing through (port area)?

PP3: It depends on the vessel. Each vessel over 250 meter is simulated by the pilots. They are also doing practical tests onboard. Either between to ports before calling (interviewee's port) or if they are sailing with the vessel before the port call in (interviewee's port). So every vessel will get an independent limitation. It could be everything from 10m/s in average to 15-16 m/s you look at as an average wind limit. Then you have darkness restrictions as well. Some vessels are allowed to come a little bit further into the (port area) before the sunrise, and some of the vessels should have daylight the whole way, so it depends from vessel to vessel.

INTERVIEWER: That is really interesting. So those decisions are taken among the pilots mutually?

PP3: Yeah the port is one thing and the pilots are another. But we have to evaluate things at every level, if we can take the ship in the port and the pilots through the archipelago. It is for example easier for (three other ports) where they have more open sailing into the berth. I think for example (other port) do not

even need a pilot, so they can just go in without one. I think it is more wind and swell that can delay or cancel a call then. We also have the (narrow port area) to handle in (interviewee's port).

INTERVIEWER: Another quick question, we talked about the app you have for the cruise calls, do you know what the motivation was to develop this app?

PP3: Yeah it was for ourselves so we could follow and see all cruise calls and have short information about it and also have a very good platform for all loose passengers and the people who are handling and taking care of the call. All from linesmen to agents to shore excursion companies and so on. That's the reason we developed it.

INTERVIEWER: That app is cruise (interviewee's port)?

PP3: Cruise (interviewee's port), yes. Thenyou have some basic information for the commuter traffic and also a little bit about taxi. And the position of the vessel and the berth that they are on.

INTERVIEWER: Anything you could think of that should be added to the app?

PP3: No… we will keep it as simple as possible, and not add too much information to it. Then it would be harder to handle. More information will… it will be tricky to find relevant information. So we will keep it very basic. Have the information that is the most important for the cruise passenger for instance.

INTERVIEWER: Is the administration of the app done through a separate system that has an integration to the app, for instance ETAs and departure times?

PP3: It is integrated to our booking system. So for instance if we change our arrival and departure times then it will send the new information to the app as well so it will have the correct arrival and departure time. So that is integrated to the booking system.

INTERVIEWER: Clever system. Reflecting on what was said today, did we forget to ask you anything?

PP3: No, I think you covered everything.

INTERVIEWER: Thank you for the interview!

7.8.10 Interview with PP4

INTERVIEWER: Could you briefly describe your role in cruise ship port calls?

PP4: I am the head of the cruise ship department in (Large Scandinavian port company operating three ports). Under me I have several terminal managers and a bunch of stevedore guys that help with luggage handling and provision and so on. We are a full-service port that handle turnarounds, transits passengers. We do handle all kinds of garbage and waste, supplies, fresh water etc, so we are a full-service port, in all three ports.

INTERVIEWER: What methods of communication do you use to handle the coordination of the port calls?

PP4: We use a booking system called PortIT, where we book the ships ahead. Normally two years ahead, where we do the schedule day by day. We get to know what time the ships arrive and how long they want to stay in port. The booking system is also reachable from our website, so external people can look at it a year in advance.

INTERVIEWER: Who has insight into that booking system?

PP4: Only the guys from my department and the marine department

INTERVIEWER: So shipping companies and external parties cannot access it?

PP4: No, they can only read the booking list. They can't adjust it.

INTERVIEWER: How well would you say this system works?

PP4: Very well

INTERVIEWER: If something goes wrong, what are the reasons?

PP4: That has never happened, but if something goes wrong it would be the user of the system

INTERVIEWER: What problems or challenges do you see in general in a cruise ship port call?

PP4: Sometimes we have congestion in the port. Sometimes when we get a booking request 1-2-3 years in advance, we have 4 piers, but it could be a day when 5 ships want to be in the port that day. Then you need to go back to the cruise line and say sorry but the port is full.

INTERVIEWER: How about the actual handling during the port call, when the ship is about to come. What challenges do you see there?

PP4: We have terminal managers who are coordinating all the practical issues, with the agent, the shore ex company, the garbage company, bunker company, provision company. It is all done manually today. The challenge is that everything needs to go via one person. I think when it comes to cruise ships you need flexibility in the system because there are different departments on the cruise ship. So it works very well here in (biggest of the three managed ports) when it is handled manually, but I also know your project and what you want to end up with.

INTERVIEWER: Oh no no, we have to step in. We can honestly say we have no desired outcome. No bias. You mentioned one person through whom all contact goes. Is that the agent in this context?

PP4: No, I am referring to our terminal manager.

INTERVIEWER: From your perspective, make a rough estimate how many port calls out of a hundred do not go as planned?

PP4: We have never had a ship leaving late from any of our ports because of the coordination at our piers.

INTERVIEWER: If you reflect from your time in (previous port of employment, large Scandinavian cruise port), would that also be the case?

PP4: There we had other issues, like the weather situation and the restrictions in the archipelago with wind restrictions which could affect time of arrival or departure. But I don't believe we had some issues because of terminal operations. There they are working a bit differently because the turnaround handling is provided by third party actors rather then by the port itself like it is here. So you have more players there.

INTERVIEWER: I remember we talked last time about the fact that there are no pilot requirements in (port). How much of a difference would you say that makes?

PP4: I think that obviously it is run very well here without pilots, but I really don't know how to answer. The ships get their key and find a way to it. In (large scandinavian cruise port) it is another situation because of the archipelago of course. In (smaller port managed by the same company) there are also some mooring issues that needs to be aware of upon arrival and departure. Here however it is just one long key with a great depth around it. So the pilot issue is not so important here.

INTERVIEWER: Before you also mentioned you didn't see any delays from operations on the pier. How about other operations, for example shore ex or passenger operations?

PP4: That can of course affect the time of departure, especially if there are traffic jams. Last summer we had one cruise ship with a lot of provisions coming, with several trucks arriving late, affecting the time of departure.

INTERVIEWER: Do you remember how much delay it was in these cases?

PP4: Oh yes. In this provision case it was like 5-6h late.

INTERVIEWER: How about shore excursions, how much would you say on average?

PP4: When it happens, less than an hour.

INTERVIEWER: (explaining thesis topic and data sharing) (14:20) What do you think would be a possible value of having more data sharing capability and more connectivity within the port?

PP4: I believe it is a good idea. As we have already talked about, there are several actors involved in a call. When it comes to the cruise lines, you have the waste management and the other things we covered before. I think it is a good idea, to have it via one channel so to say. Very beneficial.

INTERVIEWER: What kind of information would be most beneficial to be able to share?

PP4: I believe that when it comes to garbage and supplies of bunker and things like that I believe it is very useful to know when the service has arrived to the ship, and also when they are finished with the service. I believe it is very good to know when the shore excursions are coming back. That could be very useful for the ship to know. For example that they have buses arriving four o'clock and four thirty and two arriving late etc.

INTERVIEWER: (Explanation of PortCDM message format) I remember that last time you said that this format would be enough. Are my notes still correct?

PP4: Yes they are.

INTERVIEWER: We also talked with some other ports that mentioned it would be useful to be able to exchange documents, or more content data. For example how much waste the ship is planning to discharge. What are your thoughts?

PP4: I believe there are tools for that already in Sweden via the... I don't remember the system name.

INTERVIEWER: Maritime single window.

PP4: Yeah.

INTERVIEWER: A cruise manager in a Swedish port expressed an interest in having a reminder function, sending a notification automatically to the agent asking for information to be inserted or revised. He wanted the information a few days in advance so he could arrange and provide the services required. Especially during weekends for sludge and sewage handling.

PP4: I agree and disagree! There are already systems that ships are required to fill in today. If you add on more systems the risk is big that they miss something. At the end of the day you should have one system, be it the PortCDM or the single window, but you should have one system covered it all.

INTERVIEWER: In the ideal world, that would be the case. We have talked to a lot of people who share that view, especially cruise agents who expressed that for new systems to be introduced, they would need to take the place of one or more of the existing systems, only then would they bring benefits to the cruise industry. What is your take on that?

PP4: I 100% agree.

INTERVIEWER: We also talked before about departures and possible delays. How much value would you see for data sharing in those situations?

PP4: I think when it comes to if it's necessary to have a pilot, it would be good for the Swedish maritime authorities to see that. I am mostly thinking of (major Swedish cruise port) and (cruise port in Sweden operated by the company). That they could have the information, not from a phone call from the agent, but get it from this system. It would be nice. Also, the other ships could see… I don't know, are you looking into a system that other ships can see and other ports. What would happen with one ship, it being able to share information about leaving late with other ships.

INTERVIEWER: (Explanation of PortCDM maturity)

PP4: It could be a good tool for other ships to see.

INTERVIEWER: (further information of PortCDM maturity and S-211) How much value would you see with having more connectivity between ports?

PP4: When it comes to this "no special fee" regulation, it could be very good to know how much waste the ship discharged in the port before you. When it comes to that aspect, I think the sharing could be good.

INTERVIEWER: Very interesting. How much value would you see with more data sharing for collecting data for your internal use for the organisation you are employed in?

PP4: We are always interested in data when it comes to cruise. How many passenger, what nationalities etc. Today we receive information from the agent, who gets it from the ship. If we could get it straight from the ship, it would be a lot easier.

INTERVIEWER: So that would be information like the ship's characteristics, persons on board, things included in the manifest?

PP4: Exactly.

INTERVIEWER: How about these timestamps we talked about before?

PP4: It is always good to get the information if a ships is earlier or comes later, especially when it comes to the turnaround operation here, because we have a lot of crew waiting for the ship. If we could have an online update of the arrival time it would be easier to plan the personnel when they start to work and so on.

INTERVIEWER: We talked with other people last week, and such a person mentioned that it would be interesting to record your performance, for example how often you have delays, and if you have them, how much time deviation they cause. Lets say to create some internal benchmarking, what would be your thoughts on that?

PP4: Yeah yeah, I totally agree, absolutely.

INTERVIEWER: Even though you before said you don't have a lot of delays, you still think it would be useful?

PP4: When it comes to the delays of the ship or the operation?

INTERVIEWER: Lets say the overall operation, so delays and unexpected deviations from any actors involved.

PP4: Absolutely, because if you by the end of the season can speak to fore example the shore ex that this summer you had 120 buses that were later than scheduled, or you could say the we ordered waste at these times, but you arrived late 25 times last few months. It could be very useful to evaluate the seasons afterwards.

INTERVIEWER: Interesting. How much do you work together with the shore excursion agencies?

PP4: Very close.

INTERVIEWER: Interesting. One person we spoke to last week works in a city with a lot of construction work ongoing. He said that they (the port) monitor that closely and work together with the city and the shore excursion agencies to prevent delays. First of all to improve efficiency, but also to enhance guest satisfaction.

PP4: We have a similar situation here. In our other ports not so much. But here we have great network with the municipality and the tourist office and the shore excursion companies. We sit down several times before the season, during the season and after to evaluate. So we have a good cooperation here.

INTERVIEWER: (Description of thesis quantitative data findings) What are your thoughts about these findings?

PP4: I think they are correct. I believe it varies what kind of port you have. If you have a weather sensitive port, cancellation due to bad winds are more normal to to say. I am refereeing to (one of the cruise ports that is run by the company), last year we had 11 cancellations due to the wind out of 90 calls.

INTERVIEWER: 90 calls, that's a high percentage. You mentioned before delays due to shore excursions at the departure, how about delays on a arrival. I read my notes from our last discussion and see you mentioned that ships more often rather arrive too early then too late.

PP4: That's correct.

INTERVIEWER: How big of a problem is that?

PP4: It's a big problem, because you obviously need linesmen to moor the ship. You also need security guards to cover the ISPS area, so it's a big issue. Rather late then early I would say.

INTERVIEWER: Just to clarify, for you it's less inconvenient if they come later rather than too early?

PP4: Yeah.

INTERVIEWER: Interesting. How much earlier are we talking about? What is the typical timespan?

PP4: Up to one hour earlier I have noticed. I believe that from the ship side they take it for granted that they can arrive at 06:00 when they are scheduled 07:00, and that everyone should be prepared. That is seldom the case, especially not in (the smaller port they operate).

INTERVIEWER: Does it have any negative consequences for the ship if they arrive too early? Do they have to pay higher port fees?

PP4: No, but they might need to wait for half an hour to wait until the linesmen are in place, so they probably burnt a lot of fuel unnecessary to arrive at the destination early only to lie there and wait for the linesmen.

7.8.11 Interview with PA1

Participants from PA1:
***PA1a,** Operations manager*
***PA1b,** Director*

INTERVIEWER: Can you give us a brief overview of what you are doing and what your involvement is when a cruise ship comes to the port of (interviewee's port)?

PA1a: So, (our agency) is a cruise agency that is handling around 1000 calls in (Baltic/Scandinavia). We are basically the agents that are acting on behalf of the cruise ships in calls or countries where we have been appointed as their agents. We are working closely with local authorities, like immigration, customs, port authorities but also the local vendors. We make sure that every single port call goes as smooth as possible and is as efficient as possible.

INTERVIEWER: Okay. What services do you offer for the cruise ships? Besides the communications with the actors you mentioned.

PA1b: The main service is clearance, being a ship agent and clearing the ship. Otherwise the services we give are connected to the call, logistics, assisting with crew change, coordinating with deliveries and shipping, medical appointments. Anything you can think of.

INTERVIEWER: All right. What methods do you use usually to communicate and coordinate with these services?

PA1a: Emails in 99% of the cases, unless it's urgent, then the ship is calling us from their phones, either mobile phones that they have subscriptions on onboard, or satellite phones which is normally very expensive for them, so normally emails.

INTERVIEWER: All right, and just from your personal experience, how well does the overall communication with these actors work out?

PA1a: Well, sometimes for us it's something very urgent, and we have to await a reply before coming back to either the authorities or local vendors. And then people are not attending emails 24/7. These particular persons we would send an email to.. and then sometimes we cannot reach the ship through their sat phone, only they can call us.

INTERVIEWER: Ok, I see. So would you say that the main factors influencing the quality would be technical reasons?

PA1b: Not necessarily technical reasons. Communication between us, the agent and the cruise line is very efficient and fast because we are used to the setup, and we send emails regularly. But when we work with authorities and vendors that are not so used to work with emails, they might have slow response times and sometimes might come back with suggestion for dates when the ship will not even be in port. So I would say that is more knowledge about how the operation works on cruise ships, that's our biggest challenge.

INTERVIEWER: Hmm, all right, interesting. Are the certain situation or certain issues that arise in the operations of a cruise ship port call that cause any problems?

PA1b: Oh I can come up a lot of things that can cause problems.

INTERVIEWER: Haha okay, so what do you think are the most common ones?

PA1b: That is data errors. For example as we work with cruise ships that has a lot of passengers onboard, there could be wrong data about passport or visa numbers so that they get flagged by immigration. It could be the line of communication between the bridge and the first purser who is our contact person. For example if they need a tug for departure. So they forget to order it. Changing the departure time without telling us. Things like that.

PA1a: So it can be lack of communication, inter-departmentally onboard, or lack of communication between the head office and the ship. So we are in many instances requested to send information to the head offices and also to the ship. Lets say there is a new built ship going to the port for the first time, or an older ship is going to a port which they've never been to before. Then you can imagine it's a lot of planning and corrections, so sometimes just missing links of communication as well.

INTERVIEWER: Ok, interesting. I am just wondering what kind of information you are communicating with the ships, and what kind of information you are communicating with the offices? Are there certain situations where you always use one or the other channel?

PA1b: Mostly it's like this. If it's very far in advance or on a more overall basis or topic, it's with the cruise line, the head office. But operational matters and day-to-day is directly with the ships.

PA1a: Just to give you an example. Operational matters specifically linked to that call, such as ordering fresh water, disposing waste, ordering a taxi, local purchases.. everything in particular connected to that port call will be coming from the ship, and only communicated to the ship. But as I said, the preparation of a particular port call which is new to the ship has to be done with both.

INTERVIEWER: Okay, I see

PA1b: So the preparations that we do several years in advance we get from the head office, and that include information about new ports that they might not have called yet.

INTERVIEWER: Okay, lets go back to the operational situation. If you would think of the situations in the operations that would require a lot of communication with different parties, would that be the same, what you just mentioned before?

PA1b: I believe so, and a lot of the data that goes back and forth is connected to SafeSeaNet or in (country), MSW. That is what we spend the most time on gathering and uploading, because especially in (our national) system, if there are small errors in it, it has to be corrected by the vessel. It is a lot of personal data.

INTERVIEWER: That is again regarding the clearance, right?

PA1b: Yes.

INTERVIEWER: How about those situations when the schedule needs to be rescheduled, how often does it happen?

PA1b: 1 in 400-500 calls.

INTERVIEWER: Okay, so not very often.

PA1b: No, cuise ships are running on a schedule. The changes we normally do are about half an hour or an hour earlier or later arrival or departure, that's it. Then sometimes you have situations with bad weather or engine problems, that makes the schedule change. It is not like a tanker, it's very different.

INTERVIEWER: All right, interesting. For our thesis we are looking at different data sharing concepts and most of these concepts revolve around enabling more data sharing capabilities for all the actors within port. So the goal is to enable real time information sharing, to create mutual situational awareness, and to include all the actors to exchange information. What do you think about these concepts?

PA1b: I would say for a tanker, very good. Or a dry cargo ship where they would have to coordinate with receivers, stevedores and everything. But for a cruise ship, not really. Because most of the data that we spend the most time with is personal data that we are not allowed to share, and there is a reason for it. So most actors within the group, will not be permitted to have that data. So the only thing we could share in there is ETAs, which we already have set two years in advance. The things that happens on short notice, it is communicated over phones anyways, because you have people who are not online at all time. It's not like a port office where you have an officer on duty sitting in front of the computer screen all the time. We have duty personnel, but they will only react in the night when they get a call, and not sit up and check their email or check the system.

INTERVIEWER: So you are saying you are mostly using your phone, would you opinion on that change if that data sharing would happen with an app?

PA1b: No, I don't think so because there are so many people involved in a cruise call, but only a few main connectors, one being the agent. If you have to set up a system with everyone involved, that would be hundreds of people who might just need a very small fraction of data, and the rest are not allowed to see, so setting up a system with data limitations for every one of these, and having a company that you work with that might handle business onboard 1-2 cruise ships only.. I do not see it as feasible. Or main tool is our phone, it's the email. It's the actual phone. The people that we email and receive communication from ranges from a crewing agent in Indonesia to port agents in other ports, national authorities, coast guard, navy, different departments onboard the ship, head office, technical officers of the cruise line, delivery companies.. I actually think having a system would make it more complicated.

INTERVIEWER: Very interesting to hear. We are looking at one concept which is based on the exchange of timestamps. What it would do is basically focus on exchanging information relating to time, as for example "ship requested at the berth: 09:00", "cargo operation started: 10:00", "pilot cancelled for 06:00" and "pilot requested for 06:15". It would also be possible to share this data with selected actors, so it would not be a system where you write "pilot requested" and the Indonesian crewing officer and the garbage disposal get the information, but you could select who it goes to.

PA1b: Yeah, but if you look at the calls in (our country), most of the ships are not even using a pilot, and they are not requested a pilot at any time, it's a schedule they're running on. In (other country), we booked the pilot 3-6 months in advance, and it's very fixed. So we do not have the same need for this type of 15-20 minute changes or hours or delays that you do on a cargo ship. Often if the ship in (interviewee's port) wants a pilot, it's agreed two months in advance.

INTERVIEWER: Yeah because they don't need it anyway.

PA1b: Yeah, and they're not running in the same way as a cargo ship that needs to get the cargo from a to be either as cheap as possible or as fast as possible. Cruise ships even leave ports at night, then they are slow steaming to be in the next port at a scheduled time. If they go a bit faster, due to the wind or something, they just slow down to save fuel. If they are running a bit late they just speed up, so that they are there at the time they agreed so that the guests get the experience that they paid for.

PA1a: If they want to reschedule the pilot they normally just do it via VHF. Nobody even really needs to know, because if it's 15 minutes for linesmen or port security it doesn't really make any difference.

INTERVIEWER: What about 3rd party providers like sludge barges, bunker barges, fresh water providers, is there any logistical problems with any of those?

PA1b: No, most of those things are arranged by the port authorities. They have the 24h office that have the direct contact.

INTERVIEWER: (Port Officers) arrange sludge barges in Gothenburg, but not bunkering.

PA1b: Yeah bunker barges are not arranged by the port authorities, but the fresh water is. Since it's cruise ships the bunkering is normally scheduled so we know that the bunkering barge will come at lets say 12:00

PA1a: On a very busy day in (interviewee's port) with a lot of cruise ships you would receive a notification from a physical supplier that is operating the bunker barge. They would say "ok we go in this sequence, we will first bunker cruise ship a, then b, then c" so agents won't call them and ask "where is the bunker barge?" because they first needs to be done with the first and second in order to come to the third one. Again, that is something that is communicated via email or phone calls, and also on VHF with the ship when bunkering.

INTERVIEWER: All right, interesting. If there were some large schedule deviations, let's say 2hrs delay of arrival or departure. How much value would such a data sharing capability have for you?

PA1b: I don't see it having any value. It's one system more. We do have a lot of systems we work with already, like the cruise lines systems. So another system, unless it contained the functions of one or more of the others systems, I don't see any benefits and positive effects for cruise ships.

INTERVIEWER: I can see the angle that too many systems just means double the work, while not adding any redundancy. The kind of concepts we are talking about are based on technical standards that allows inter-connectivity between various systems, so that everyone can share data via the same standards, so it would have a lot of potential. I can however see the first phase being an annoyance, and double work.

PA1b: I do see the system having a lot of functionality, and working well, for cargo ships, where the timestamps are very important for a tanker or a dry cargo ship, when you need to know if something is issued before or after midnight, and all of those things. I do understand the system for that, but not for cruise ships.

INTERVIEWER: That's interesting. We choose to target the cruise ship segment because that's where you might immediately see any benefits. In cargo shipping, most people would absolutely agree with you. I would like to run you through a few more questions, then we can tell you our experiences from other people we have talked to so far. Before we called you, we analyzed a set of data, which analyses incidents at cruise ship port calls. Any event that resulted in delays over 1hr. We found three reason, or three examples that are firstly quite common from other events, and second, would benefit from enhanced data sharing. These three examples are: firstly, when a port is cancelled on a very short notice, so for example because of wind. Secondly, at the arrival, again mostly because of the wind. The ship comes late into the port and has to reschedule all the events and operations. Third, delays at departure because of for example shore excursions being delayed returning. What are your thoughts on these three examples?

PA1b: Generally if it is a delay for an arrival or an cancellation we would call, after getting the data via a call from the ship, everybody involved, because this is not a situation where you want to rely on everybody going into a system and checking it, that's something that has to be done in real time, and you have to get the acknowledgement that everyone has been informed. That is our responsibility. If it's delays in

departure, normally that happens because of passengers being late already after the pilot has gone onboard, linesmen are already on the quayside, so there is nobody you would need to call. So you wait on the quayside because the pilot or captain has already informed the port control on VHF. It is quite rare that we wait for more than 10 minutes for passengers being late, unless it's because of a traffic accident, and you have many passengers that has not made it back yet. Otherwise the ship would sail and the passengers who missed the ship will be sent by train, bus or flight to the next port.

INTERVIEWER: All right. How often do delays or having to reroute the ship happen?

PA1b: I think we had 3 out of 900 calls last year.

INTERVIEWER: Oh wow, that's a good statistic for your organization. The data we've analyzed of 40 cruise ships over a period of 3 years points at it happening quite a lot. It's about 5% of the calls, being a deviation of over one hour.

PA1b: Which ports?

INTERVIEWER: Yeah that is the thing. What we can conclude from this is that the ports in northern Europe are rather good planning wise.

PA1b: I think you have to look at the geographical data. We have calls in Scandinavia and the Baltic. I know there is the same for other colleagues in northern Europe. I do understand Caribbean, southern Europe, Asia have different issues. Maybe even in the US there might be issues with immigration.

INTERVIEWER: Lets rephrase the question a bit: Is there any area in which you feel like more data sharing would be beneficial, and in that case what specific data?

PA1b: Not directly, I can't say that sharing more in this sense... the thing is that we just need the cruise line to share more with their ships or getting the ships to actually use the data they have available. But that's cultural change, then anything else.

INTERVIEWER: That's interesting. We've heard so many different perspectives now and it really has opened our eyes to the issues. Many has voiced the same opinions that you have with cruise shipping being already very advanced in data sharing. Maybe that is why it is so precise, and it could be a good learning lesson for the cargo industry can take from the cruise lines. That the already enhanced data sharing is allowing for increased precision.

PA1b: Yeah, but it is also very different. Cruise ship go on a schedule that is fixed already 2-3 years in advance. They have to stick to that because the passengers have bought that. You can't change, where on a tanker sailing from a to b having to deviate because the cargo being sold.

INTERVIEWER: Certainly.

PA1b: Cruise shipping is a totally different area. Sure it's also shipping, but you cannot compare them. Cruise ships choose to go to a certain port. Cargo ships are forced to go to a port because that's where they have to get or deliver the cargo.

PA1a: Two weeks ago we had an event where itinerates for 2020/2021 where launched, so if you go on the websites of the cruise lines you can already book your vacation to go to these places. It would have to be very adverse weather conditions for there to be deviations. Are you lagging a bit behind the captain just speeds up and burns a bit more fuel, that's the way it is. They knows very well that everything is arranged upon arrival. Linesmen, shore excursions, everything related to the passengers, logistics, so it's worth speeding up. For (our country) apart from (one port) the pilotage is not compulsory, so of course the captain wants to get to port as fast as possible.

INTERVIEWER: How would the operation look to find a suitable replacement port in case of adverse weather etc? Is there already a plan B set in place or do you think on your feet?

PA1b: We still have to think on our feet's when something happens, but due to our experience in different ports, we know what the options are. We know the schedules for other ports. What is option b for one ship is not the same for others, because it also depends on the rest of their itinerary, where they come from and where they are going. The size of the ships also matters. If it's a small ship you have more options then if it's a big ship.

PA1a: How many passengers do you have onboard? Do you want to go alongside? Do you want to anchor? Do you want to tender in that port? Or do you just need to sail further to berth somewhere.

INTERVIEWER: Yeah of course it's a lot of information revolving around such a situation. Of course you would choose the easiest communication method.

PA1b: Yeah, and also two things that have to do with that decision are immigration and customs. Especially now with Brexit, what will the status of the passengers be?

PA1a: One thing we saw more and more last year is requests to use whatsapp. Ships are communicating with their agents in the Caribbean using whatsapp, so they are already used to it.

INTERVIEWER: Whatsapp, oh. Interesting.

PA1a: Yeah there are so many things you want to do immediately, and it is very flexible and agile, and it does work well when you want a backup. I am missing a taxi, bus has not arrived yet, should we have a coffee onboard etc etc. If it's something that they're asking for that we need to have as an email-backup for our invoicing, it doesn't work so we said no to it, even though they are already used to it from other parts of the world.

INTERVIEWER: Oh okay, interesting. Why can't you use it for your invoicing? I mean it's an electronic record, right?

PA1b: Yeah it is, but there are requirements from the cruise line and their auditors.

PA1a: You don't really have a signature in whatsapp. You don't have a phone number and position of that person. There are hundreds of people exchanging on a cruise ship on an annual basis.

INTERVIEWER: Makes sense, fair enough. We have everything crossed off our checklist. Just to reflect on everything that was said, do you think we missed something?

PA1b: Not for cruise ships.

PA1a: I have to disagree a little bit with my colleague PA1b, because I'm a more tech-savvy person. I do like the idea of having an app sharing the information. We would have to come up with notifications and people would have to get used to it. It's in a very early stage. I don't feel like it's a bad idea, but in a way it cannot be compared with cargo ships. If it boosts efficiency and not just takes over one of the softwares that we're using, but synchronies all the data, then it's also for cruise ships.

PA1b: But it has to be a much more wider scope of data.

INTERVIEWER: Not just timestamps? So you mean including clearance, information, documents, information about ship wants to do etc.

PA1b: All of that is planned in advance, so it's more requests, port information, all of those things. In ports we don't care if ships are arriving 08:50 or 09:10. We don't use that data for anything. We care about data for requests we have to use it for, sludge requests etc. It has to be in a format so that the right people can

read it, and the people who are not allowed to see it, cannot see it. Personal data of the personal and the crew.

PA1a: The most sophisticated system is SafeSeaNet Norway, where you are uploading all the documents within one file. Through that system you can actually order fresh water, bunkering, waste discharge, lines-men, inform the port authorities of bunker operations or some works onboard, technicalities you have to deal with. So everything goes through that one system, and it's the smartest one we have in Europe.

INTERVIEWER: Since a concept like this is most likely going to be commonplace in cargo shipping in a few years, once it is refined enough and agencies around the world are familiar with using it, do you think it will have a natural transition into cruise as well? So the long-term perspective.

PA1b: Only if you can find a way to integrate it with the systems that the cruise ships use onboard. The cruise ships also has to know everything about each port, and they are in a new port every day. The purse onboard needs to be able to share data and for a system to be integrated to their onboard system means that personal data should not need to be copy pasted into excel sheets for MSW in (our country) for example, but take it directly from their system and send it over, then you have a good idea. But you have to get it integrated with their system.

INTERVIEWER: Yes, connectivity with national single windows is a big issue to solve.

PA1b: Yes, and without getting that integration I don't see it working for a long time, you need to be able to save time and systems, not add more.

INTERVIEWER: (Adrian giving an example of a planned departure being delayed due to late passenger flights and the ship having to decide whether to wait several hours or to leave the passengers due to long river passage and insufficient pilots) – That would be a scenario where more data sharing would be beneficial?

PA1b: I do see that aswell. But I see it more as an issue between the Pilot, the Captain and bridge team and the port authority. We need to notified and we wait to make the arrangements needed, we are not in the decision.

INTERVIEWER: Yeah of course, you are the communication piece. We have heard from various ports that they see this concept as a potential tool for agents, if 3rd parties are integrated. You could already early on get notification of potential delays. But your opinion seems to be opposing?

PA1b: Yeah, but you need to get more systems integrated. You don't have the people in the airport that are using Amadeues or whatever it's called, the airline system. They get their push-notification from there that the flight is delayed. You need more integration to cut down the workload. Then it's the matter of who has access and who defines who has access. Is it a system the agent should have, is it a system the port should have, is it a system the ship should have? Who is the owner of the system?

INTERVIEWER: Yeah there are a lot of technical questions that needs to be clarified. We are looking into more of if more data sharing can add value to the cruise industry. Thank you for the interview!

8 References

Afuah, A. (2003). *Innovation management. : strategies, implementation and profits (2nd ed.)*: New York : Oxford University Press.

Bichou, K. (2009). Port operations, planning and logistics, Informa Law. In: Routledge.

Blonigen, B. A., & Wilson, W. (2006). *New measures of port efficiency using international trade data*. Retrieved from National Bureau of Economic Research (U.S.): https://www.nber.org/papers/w12052

Boonzaier, J. (2017). Mega cruiseships are getting too big for their ports. Retrieved from www.Tradewindsnews.com/TWplus/1368889/mega-cruiseships-are-getting-too-big-for-their-ports, 25.01.2019

Bouman, E. A., Lindstad, E., Rialland, A. I., & Strømman, A. H. (2017). State-of-the-art technologies, measures, and potential for reducing GHG emissions from shipping – A review. *Transportation Research Part D, 52*(Part A), 408-421. doi:10.1016/j.trd.2017.03.022

Bryman, A., & Bell, E. (2015). *Business research methods (4. ed.)*: Oxford : Oxford Univ. Press, c2015.

.

Brynolf, S., Baldi, F., & Johnson, H. (2016). Energy Efficiency and Fuel Changes to Reduce Environmental Impacts. In K. Andersson, S. Brynolf, J. F. Lindgren, & M. Wilewska-Bien (Eds.), *Shipping and the Environment : Improving Environmental Performance in Marine Transportation* (pp. 295-339). Berlin, Heidelberg: Springer Berlin Heidelberg.

Bumann, A. (2015). Cruise Ships and Tender Boats in the Port of Santorini. Private Collection: Private Collection.

Carlan, V., Sys, C., Vanelslander, T., & Roumboutsos, A. (2017). Digital Innovation in the Port Sector: Barriers and Facilitators. *Competition and Regulation in Network Industries*(Issue 1-2), 71.

CLIA. (2018). 2019 Cruise Trends & Industry Outlook. Retrieved from https://cruising.org/news-and-research/-/media/CLIA/Research/CLIA%202019%20State%20of%20the%20Industry.pdf, 26.02.2019

Corbin, J. M., & Strauss, A. L. (2008). *Basics of qualitative research. [electronic resource] : techniques and procedures for developing grounded theory* (3e [ed.] / Juliet Corbin, Anselm Strauss. ed.): SAGE.

Crew Center. (2018). Ships descriptions and itinerarys 2018. Retrieved from http://crew-center.com/itinerarys, 14.02.2019

Cruise Market Watch. (2018). 2018 Worldwide Cruise Line Passenger Capacity. Retrieved from https://cruisemarketwatch.com/capacity/, 13.02.2019

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.

Dale, A., Arber, S., & Procter, M. (1988). *Doing secondary analysis*. London; Boston: Unwin Hyman.

Davim, J. P., & Machado, C. (2015). *Innovation Management : In Research and Industry*: Berlin/Boston : De Gruyter, [2015].

Dowling, R. K. (2006). *Cruise ship tourism.* : Wallingford, UK ; Cambridge, MA : CABI Pub., c2006.

Eide, M. S., Longva, T., Hoffmann, P., Endresen, Ø., & Dalsøren, S. B. (2011). Future cost scenarios for reduction of ship CO2 emissions AU - *Maritime Policy & Management, 38*(1), 11-37. doi:10.1080/03088839.2010.533711

Eskelinen, M. (2018). *Implementation of Port Call Synchronisation A case study of the Energy port in Gothenburg.* (M.Sc.), Chalmers University of Technology, Göteborg.

Eurocontrol. (2017). Airport Collaborative Decision Making (A-CDM). Retrieved from https://www.eurocontrol.int/articles/airport-collaborative-decision-making-cdm, 13.02.2019

European Commission. (2011). *Summary report of the contributions received to the e-Maritime public online consultation. C.2 Maritime transport policy: Ports & inland waterways* Retrieved from Brussels:

European Commission. (2019). European maritime Single Window Environment. Retrieved from https://ec.europa.eu/transport/modes/maritime/digital-services/e-maritime_en, 04.04.2019

Faber, J., Nelissen, D., Hon, G., Wang, H., & Tsimplis, M. (2012). Regulated slow steaming in maritime transport: An assessment of options, costs and benefits. *CE Delft. Delft, Netherlands*.
Goffin, K., & Mitchell, R. (2017). *Innovation management - effective strategy and implementation*: London : Palgrave ; [New York, NY] : Macmillan Education, 2017.
Gui, L., & Russo, A. P. (2011). Cruise ports: a strategic nexus between regions and global lines—evidence from the Mediterranean*,* 129.
Haraldson, S. (2015). *Digitalization of Sea Transports – Enabling Sustainable Multi-Modal Transports*. Paper presented at the Twenty-First Americas Conference on Information Systems, Fajardo, Puerto Rico.
Harati Mokhtari, A., Wall, A., Brooks, P., & Wang, J. (2008). *Automatic Identification System (AIS): A Human Factors Approach*.
Heilig, L., Schwarze, S., & Voß, S. (2017). An analysis of digital transformation in the history and future of modern ports.
IPCSA. (2014). Port Community Systems. Retrieved from https://ipcsa.international/pcs, 01.03.2019
Jenssen, J. I. (2003). Innovation, capabilities and competitive advantage in Norwegian shipping. *Maritime Policy & Management, 30*(2), 93-106. doi:10.1080/0308883032000084841
Johansson, H. J., McHugh, P., Pendlebury, & Wheeler, W. A. (1993). *Business Process Reengineering*: Chichester: John Wiley & Sons.
Johnson, H., & Styhre, L. (2015). Increased energy efficiency in short sea shipping through decreased time in port. *Transportation Research Part A, 71*, 167-178. doi:10.1016/j.tra.2014.11.008
Jordan, A. (2017). LNG-Powered Cruise Ships Lead the Way. Retrieved from https://maritime-executive.com/article/lng-powered-cruise-ships-lead-the-way, 13.02.2019
Jotron. (2019). Products: GMDSS, AIS AND LIGHTS. Retrieved from https://jotron.com/product-category/gmdss-ais-lights/?page=2, 14.03.2019
Kennedy, O. R., Lin, K., Yang, H., & Ruth, B. (2011). Sea-port operational efficiency: an evaluation of five Asian ports using stochastic frontier production function model. *Journal of Service Science and Management, 4*(3), 391.
Kennedy, R. D. (2019). An investigation of air pollution on the decks of 4 cruise ships.
Kuckartz, U. (2012). Qualitative Inhaltsanalyse.
Lambrou, M. (2016). Innovation Capability, Knowledge Management and Big Data Technology: A Maritime Business Case. *International Journal of Advanced Corporate Learning (iJAC), 9*(2), 40. doi:10.3991/ijac.v9i2.6010
Lind, M. (2018). Digital data sharing in maritime transport chains. *Digital Ship*(November), 16.
Lind, M., Andersen, T., Bergmann, M., Watson, R., Haraldson, S., Rygh, T., . . . Kinn, M. (2018a). Coordinated Value Creation in Cruise Call Operations-The case of the Port of Stavanger
Lind, M., Andersen, T., Bergmann, M., Watson, R., Haraldson, S., Rygh, T., . . . Kinn, M. (2018b). *Coordinated Value Creation in Cruise Call Operations-The case of the Port of Stavanger Introduction-the passenger experience*.
Lind, M., Andersen, T., Bergmann, M., Watson, R. T., Haraldson, S., Karlsson, M., . . . Bjørn-Andersen, N. (2018). The maturity level framework for PortCDM.
Lind, M., Bergmann, M., Bjorn-Andersen, N., Robert, W., Haraldson, S., Watson, R., . . . Gonzales, A. (2019). *PortCDM Concept Note 22 - Substantial value for shipping found in PortCDM testbeds*.
Lind, M., Bergmann, M., Watson, R., Haraldson, S., Park, J., Gimenez, J., . . . Voorspuij, J. (2018). *Towards Unified Port Communications-from a project format to a global standard*.
Lind, M., Haraldson, S., Karlsson, M., & Watson, R. T. (2015). *Port collaborative decision making–closing the loop in sea traffic management.* Paper presented at the 14th International Conference on Computer Applications and Information Technology in the Maritime Industries, Ulrichshusen, Germany.
Lind, M., Haraldson, S., Karlsson, M., Watson, R. T., & Holmberg, P.-E. (2015). Enabling Port Efficiency by increased Collaboration and Information Sharing–Towards a Standardized Port Call Message Format. In: WCTRS-SIG2, The Port and Maritime Sector: Key Developments and Changes ….

Lind, M., Haraldson, S., Ward, R., Bergmann, M., Bjørn-Andersen, N., Karlsson, M., . . . Gonzales, A. (2019). *STM Validation Report - Improving port operations using Port Collaborative Decision Making*. Retrieved from

Lind, M., Lane, A., Bjørn-Andersen, N., Ward, R., Michaelides, M., Sancricca, M., . . . Andersen, T. (2018). Ships and Port Idle Time: Who are the Culprits?

London, W. (2013). Economic Risk in the Cruise Sector. *Études caribéennes*. doi:10.4000/etudescaribeennes.5134

London, W., & Lohmann, G. (2014). Power in the context of cruise destination stakeholders' interrelationships. *Research in Transportation Business & Management*. doi:10.1016/j.rtbm.2014.11.004

MED-PCS. (2013). *D411 - General study "Implementation of the PCS in Europe". Promotion of "Port Community Sys-tem" in Mediterranean Traffic*. Retrieved from http://www.med-pcs.eu/multimedia-area/42-documents/d411-general-study-implementation-of-the-pcs-in-europe:

Micallef, J. V. (2018). The Cruise Industry's Boom Is Primed To Continue. Retrieved from https://www.forbes.com/sites/joemicallef/2018/09/01/the-cruise-industrys-boom-is-primed-to-continue/, 25.01.2019

Novotný, R., Kuchta, R., & Kadlec, J. (2014). Smart city concept, applications and services. *Journal of Telecommunications System & Management, 3*(2), 1.

Pallis, A. A., Arapi, K. P., & Papachristou, A. A. (2019). Models of cruise ports governance. *Maritime Policy & Management*, 1-22.

Penco, L., & Di Vaio, A. (2014). *Monetary and non-monetary value creation in cruise port destinations: an empirical assessment* (Vol. 41).

Peppard, J., & Rylander, A. (2006). From Value Chain to Value Network. (2-3), 128.

Port of Gothenburg. (2018a). Cruise Terminals Gothenburg. Retrieved from https://www.portofgothenburg.com/cruise-and-visits/cruise/cruise-terminals/, 26.02.2019

Port of Gothenburg. (2018b). Port Tariff for the Port of Gothenburg. Retrieved from https://www.portofgothenburg.com/maritime/port-tariff/, 01.01.2019

Porter, M. E. (2004). *Competitive advantage : creating and sustaining superior performance*: New York ; London : Free Press, 2004.

Rodrigue, J.-P., & Notteboom, T. (2013). The geography of cruises: Itineraries, not destinations. *Applied Geography, 38*, 31-42. doi:10.1016/j.apgeog.2012.11.011

Rodrigue, J.-P., Slack, B., & Comtois, C. (2006a). *The geography of transport systems*: Abingdon, Oxon, England ; New York : Routledge, 2006.

Rodrigue, J.-P., Slack, B., & Comtois, C. (2006b). *The geography of transport systems*: Abingdon, Oxon, England ; New York : Routledge, 2006.

Ruane, J. M. (2016). *Introducing social research methods: essentials for getting the edge* (1 ed.). Hoboken, NJ;Chichester, West Sussex, UK;: WILEY Blackwell.

Rygh, T. (2018). *Alternatives for the Development of the Maritime business in Rogaland.* (M.Sc.), University of Stavanger, https://brage.bibsys.no/xmlui/handle/11250/2570592

Saldaña, J., Leavy, P., & Beretvas, N. (2011). *Fundamentals of qualitative research*. New York: Oxford University Press.

Santorini Port. (2018). Santorini Port Schedule June 2018. Retrieved from https://www.santoriniport.com/june-2018-santorini-cruise-ship-timetable-schedules/, 26.02.2019

Saunders, M., Lewis, P., & Thornhill, A. (2016). *Research methods for business students* (7. ed.). Harlow: Pearson Education.

Schreier, M. (2014). *Varianten qualitativer Inhaltsanalyse: Ein Wegweiser im Dickicht der Begrifflichkeiten.* Paper presented at the Forum Qualitative Sozialforschung.

Shani, A. B. (2009). *Behavior in organizations: an experiential approach* (9. ed.). New York: McGraw-Hill.

Srour, F. J., van Oosterhout, M., & van Baalen, P. (2008). Port community system implementation: Lessons learned from international scan. *Transportation Research Board 87th Annual Meeting, Washington DC*.

STEAM. (2019). STEAM Objectives. Sea Traffic Management in the eastern Mediterranean. . Retrieved from https://steam.cut.ac.cy/steamobjectives/, 01.03.2019

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.

UNCEFACT. (2012). The characteristics of a Single Window. Trade Facilitation and Implementation Guide. . Retrieved from http://tfig.unece.org/contents/single-window-concept.htm, 04.04.2019

UNCTAD. (2018). Merchant fleet by country of beneficial ownership, annual, 2014 - 2018 Retrieved from https://unctadstat.unctad.org/wds/TableViewer/tableView.aspx, 13.02.2019

Vaggelas, G. K., & Pallis, A. A. (2010). Passenger ports: services provision and their benefits. *Maritime Policy & Management, 37*(1), 73.

Véronneau, S., Roy, J., & Beaulieu, M. (2015). Cruise ship suppliers: A field study of the supplier relationship characteristics in a service supply chain. *Tourism Management Perspectives, 16*, 76-84. doi:10.1016/j.tmp.2015.07.008

Vidmar, P., & Perkovič, M. (2015). Methodological approach for safety assessment of cruise ship in port. *Safety Science, 80*, 189-200. doi:10.1016/j.ssci.2015.07.013

Wang, K., Wang, S., Zhen, L., & Qu, X. (2017). Cruise service planning considering berth availability and decreasing marginal profit. *Transportation Research Part B: Methodological*, 1. doi:10.1016/j.trb.2016.10.020

Watson, R., Howells, J., & Boudreau, M.-C. (2013). *Energy Informatics: Initial Thoughts on Data and Process Management*.

Watson, R., Lind, M., & Haraldson, S. (2017). *Physical and Digital Innovation in Shipping: Seeding, Standardizing, and Sequencing*.

World Bank. (2007). Port Reform Toolkit. Retrieved from https://ppp.worldbank.org/public-private-partnership/library/port-reform-toolkit-ppiaf-world-bank-2nd-edition,