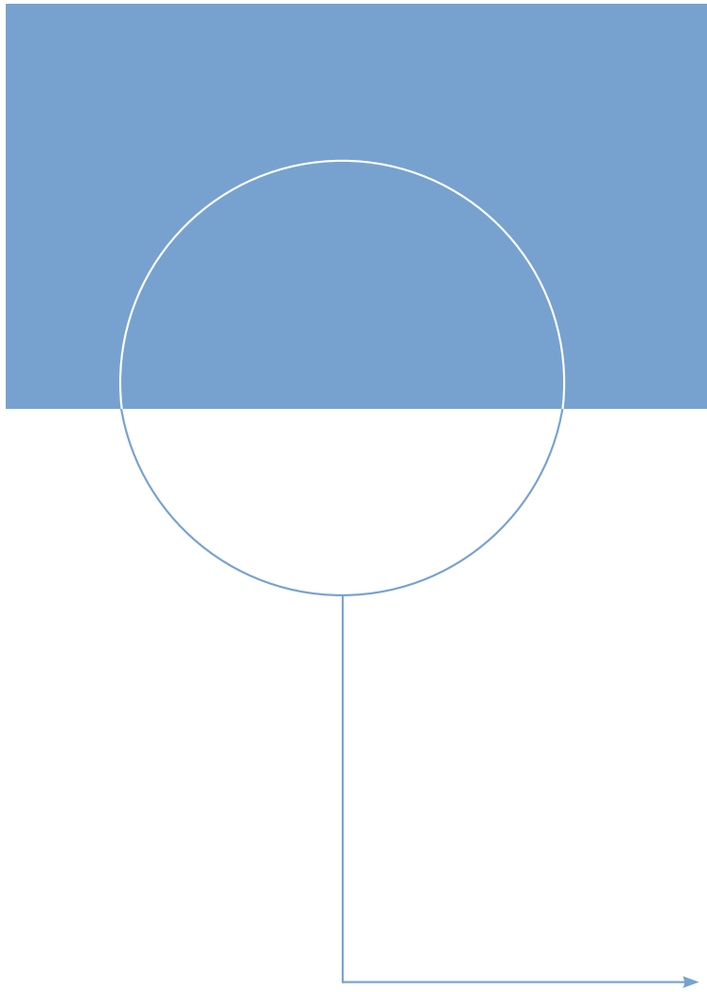

Master's thesis

2020

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Keeping the ship afloat

How can Norwegian yards become more viable in increasingly complex markets?

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Submission date: June 2020
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Preface

This master thesis is written at the Department of Industrial Economics and Technology Management (IØT) at the Norwegian University of Science and Technology (NTNU). The work completes a Master of Science degree, and is written by two students within the field of Strategic Change Management and Strategic Purchasing and Supply Management. We both have a specialisation within marine engineering. With a strong interest in the maritime industry, we wanted to apply our knowledge about strategy within this industry. The thesis was therefore written in close collaboration with a company from the maritime cluster on the West-Coast of Norway.

We want to thank our two supervisors Heidi Carin Dreyer and Hanne O. Finnestrand for supporting us in our endeavour of writing a thesis that can contribute to both the theoretical research, but also to the industry. You have provided us with a solid foundation within the fields of change management, and purchasing and supply management. Without your insights, we would not have discovered the Viable Systems Theory, which proved to be the golden mean between our wish to contribute both to the industry and to research, and delve into something we are passionate about. We are thankful to have learned about the power of the Viable Systems Model, and to be co-supervised by an expert within this field: Robert L Flood. Thank you Bob for your encouragement and useful insights.

The Viable Systems Model way of thinking and analysing has given us many new insights. We hope that our work can do the same for the company we analysed. Thank you to the two company representatives who have given us so much of their time. The time you have spent helping us has influenced more than just our thesis - we have gained knowledge that we will bring with us now that we will finally enter the industry ourselves.

And lastly, we want to thank our family, friends and fellow students for the continuous support throughout this work.

Lisa Lönne Myre and Astrid Stensvand Tenden
Trondheim, June 2020

Abstract

The Norwegian yards are currently experiencing issues with productivity and profitability losses. The purpose of this thesis is to explore how Norwegian yards can increase their viability in markets that are becoming increasingly complex. This is related to the general slowdown of the economy since the financial crisis in 2008, as well as the decline in the offshore market in 2014. The Norwegian yards have positioned themselves in new market segments, such as cruise and offshore wind. These segments are uncharted waters for them. This adds to the profitability challenge, as it is recognised that it takes time to streamline the new value chains. The yards operate with increasingly complex and entangled engineer-to-order supply chains, and the research on how to efficiently manage these is scarce. By examining a whole organisation and analysing how its entities are related, sub-optimal management can be avoided, and the profitability of the company as a whole can be increased. As there is a need for a holistic approach to understand what hinders the Norwegian yards in becoming more productive and profitable, systems theory provides the theoretical foundation for this thesis. By applying the Viable Systems Model on a Norwegian yard, insights on how viability principles are violated have surfaced.

The diagnosis of the Norwegian yard identifies eight discussion points that have been addressed with company representatives. These findings stem from three overarching viability violations. Firstly, the coordination function in the focal company should be improved to handle necessary information flow. Secondly, the lack of autonomy in operations seems to create extensive coordination efforts in meeting activities and affects the daily decision-making. Lastly, the subsidiaries of the focal company are profit seeking and have a bargaining relationship that seems to hamper their collaboration in some phases of the shipbuilding process.

The findings indicate that there are several hindrances to the viability of Norwegian yards. This thesis serves as a good basis to address them. The thesis ultimately adds to the discussion on how to increase productivity and profitability in today's challenging markets, as the viability violations that are identified can be related to the general industry. The Viable Systems Model has, to the best of our knowledge, never been applied to European shipyards before, and we therefore argue that the world of Viable Systems Model can gain new insights. With this thesis, the applicability and versatility of the viable systems theory is confirmed.

Sammendrag

De norske verftene opplever for øyeblikket utfordringer knyttet til produktivitet og tap i lønnsomhet. Formålet med denne oppgaven er å utforske hvordan norske verft kan øke deres levedyktighet i markeder som blir mer og mer komplekse. Disse utfordringene er knyttet den økonomiske nedgangen i markedet siden finanskrisen i 2008, samt nedgangen i offshore-markedet i 2014, hvilket har ført til lavere markedsetterspørsel. Norske verft har beveget seg inn i ukjente farvann ved å posisjonere seg i markedssegment som cruise og offshore wind. Dette øker utfordringen knyttet til lønnsomheten, og det tar tid å strømlinjeforme nye verdikjeder. Verftene opererer i engineer-to-order verdikjeder som blir mer og mer komplekse, og det er ikke tilstrekkelig forskning om hvordan å styre disse. Ved å betrakte organisasjonen i sin helhet, og å analysere sammenhenger innad, kan suboptimal ledelse bli unngått, hvilket kan lede til økt lønnsomheten for bedriften. Det er behov for en holistisk tilnærming for å forstå de hindrene for økt lønnsomhet og produktivitet som norske verft står ovenfor. Det er på dette grunnlaget at systemteori blir benyttet i denne oppgaven. Ved å anvende "Viable Systems Model" på et norsk verft, har det blitt pekt på flere brudd av levedyktighetsprinsipper.

Diagnosen av det norske verftet har identifisert åtte funn som har blitt diskutert med bedriftsrepresentanter. Disse funnene stammer fra tre overordnede brudd på levedyktighetsprinsippene. For det første må koordinasjonsfunksjonen til det norske verftet forbedres for å kunne takle informasjonsflyten. For det andre mangler de forskjellige operasjonene i bedriften autonomi. Dette krever omfattende koordinasjon av møteaktivitet, og påvirker den daglige beslutningstakingen. Til slutt er datterselskapene profitt-søkende, og har et forhold basert på forhandlinger. Dette ser ut til å hindre deres samarbeid i noen faser av skipsbyggingsprosessen.

Funnene indikerer at det eksisterer flere hindringer i levedyktigheten til norske verft, og denne oppgaven fungerer som en god basis for å diskutere disse. Oppgaven vil bidra til diskusjonen om hvordan å øke produktivitet og lønnsomhet i dagens utfordrende marked, ettersom at hindringene på levedyktigheten blir relatert til industrien rundt case-firmaet. Viable Systems Model har, så vidt vi vet, aldri blitt brukt på europeiske verft før, og det argumenteres derfor for at den kan bidra med ny innsikt til Viable Systems Model-verdenen. Med denne oppgaven er anvendbarheten og allsidigheten til Viable Systems Model bekreftet.

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Abbreviations

C1	Channel 1
C2	Channel 2
C3	Channel 3
C4	Channel 4
C5	Channel 5
C6	Channel 6
CRM	Customer Relations Management
D	The design department in the focal company
ETO	Engineer-to-order
GTS	General Systems Theory
IN	The development and international growth department
MTS	Make-to-stock
OSV	Offshore Supply Vessels
S1	System 1: Operations
S2	System 2: Co-ordination
S3	System 3: Control
S4	System 4: Intelligence
S5	System 5: Policy
SCM	Supply chain management
SS	The Shared Services department
SPU	The strategic purchasing department
VSM	Viable Systems Model
Y	The yard subsidiary in the focal company

Chapter 1

Introduction

1.1 Problem statement

In recent time, the activities at shipyards have changed in several ways. A paradigm shift was that companies started outsourcing several of the production phases performed in shipbuilding (Andritsos and Perez-Prat, 2000; Held, 2010). According to Held (2010), as much as 60-80 % of the added value in shipbuilding is now externally produced, which increases the complexity of efficiently managing the maritime supply chain. Moreover, after the recent intensification of the globalisation process, shipbuilding companies now have to manage activities performed by a worldwide network of suppliers (Mello and Strandhagen, 2011; Holte et al., 2009). In addition to this, the industry has been severely affected by the general slowdown of the world economy caused by the financial crisis in 2008, and the decline of the oil-price in 2014. This is especially true for Norwegian yards, where construction of Offshore Support Vessels (OSVs) was the main newbuild activity at that time. The demand for these ships plummeted, and the yards had to look for new business. Many yards showed excellent restructurability capabilities by positioning themselves in new key growth markets such as ferry and exploration cruise, fishery and aquaculture, and offshore wind vessels(Menon, 2019a). Consequently, many new suppliers from all over the world have been introduced to these shipyards after the industrial crisis, and it is recognised that it takes time to streamline the new supply chains with their different players (GCE Blue Maritime Cluster, 2019). The challenging markets, the increased number of suppliers due to outsourcing and globalisation and the restructured supply chains, seem to have reduced the profitability of Norwegian shipyards. In an effort to make the companies more economically viable in today's challenging market situation, research on how to structure and manage the organisations must be conducted. This is vital to be able to efficiently handle the complex and entangled new supply chains of the industry.

In more recent years, the shipbuilding community has become increasingly aware of the significance of supply chain management (SCM) (Semini et al., 2014). However, this literature mainly concentrates on sectors of high volume and lower complexity (Mello and

Strandhagen, 2011). Less attention is given to SCM in complex project environments such as in the engineer-to-order (ETO) context, which is where most shipbuilding companies operate. Mello and Strandhagen (2011) state that there is a lack of research on the role of SCM in shipbuilding. SCM is problematic in these types of organisations, as the complex nature of a ship creates considerable coordination challenges for all stakeholders that are a part of the project (Held, 2010). Additionally, the complexity is increased by the significant amount of information that must be communicated, the numerous engineering disciplines that are involved (Petersen et al., 2005), and the need to consider specific customer requirements (Rahim and Baksh, 2003). Even though the Norwegian industry did well in restructuring their operations, both yards and design companies are struggling with profitability and productivity today. They should exploit the opportunities that lie in SCM, as the new supply chains present themselves as more complex and globalised than ever before. To identify possible improvements for handling the productivity and profitability challenges, more empirical research on the field is required.

The aim of our thesis is to better understand the issues that shipbuilding organisations are facing today and how they can tackle them. The challenge of becoming more viable in the rapidly changing market segments is not only linked to supply, demand and prices. The organisational nature of the companies competing in the environment adds to the complexity as well. To paint a picture: it is not only the "rough seas" in the market that influences if an organisation will survive. Independently of market fluctuations, the organisational structure of the company must provide the proper "longitudinal and transverse beams to keep the ship afloat". Only then can one assure that the ship will be viable in any environment it may find itself in. Hence, we want to explore the following problem statement:

How can Norwegian yards become more viable in increasingly complex markets?

The organisation of shipbuilding companies was already complex when they built OSV's before the oil-crisis. But the diversification of market segments, the increase in suppliers and new relations increases this complexity, and must be dealt with by an analytical framework that can both see and handle this. This has pulled us towards applying the "Viable Systems Model"(VSM) as a diagnostic tool. This systems theory emphasises how the organisational structure and the functionality of the operations affect how economically sustainable an organisation is. Is the organisational structure causing any dysfunction, reducing efficiency and effectiveness, leading to reduced profitability? The VSM focuses on challenges that emerge from the organisational structure of the shipyards, rather than the complexity added by the surroundings and the peculiarities of the shipbuilding industry. Findings from a VSM diagnosis can perhaps warrant fruitful discussions with company representatives, both connected to coordination, but also other issues related to the viability of the daily operations. Engaging people who may support the process of change will hopefully contribute to building a better future for the shipyard. We hope to contribute with new knowledge in the world of VSM and the industry itself through our analysis. As, to the best of our knowledge, the VSM has never been applied on a shipyard before.

1.2 Research scope

To study the problem statement of this thesis, an empirical study of a Norwegian shipbuilding company is conducted. Systems theory will form the basis for the analytical framework that is applied. The system in focus will be a focal company that is located at the West-Coast of Norway. This is an umbrella organisation that will be further denoted as the Group in this paper. The Group is a family-owned company comprising of several marine subsidiaries within ship design & solutions, shipbuilding, electronics, servicing, ship owning, global sales and project making. A large share of their operations is project making at shipyards worldwide. However, the scope of this study will be limited to look at the design, building and commissioning of vessels at the yard in Norway. Projects conducted at this yard involves several of the subsidiaries in the Group. This gives insight into how the different entities of the Group work together in a complex project environment, and may indicate how viable and sustainable the company is as a whole. We argue that the findings that surface when applying the VSM to our chosen focal company provides a perception on what might be challenging for many Norwegian yards, as they all operate in a similar environment. They have all been through tough market changes, and are also largely affected by the peculiarities of the shipbuilding industry in Norway. Hence, by understanding what is challenging for the viability of the focal company, insights into viability for similar organisations in the industry is gained.

1.3 Structure

In the next section of this thesis, Chapter 2, the theory on both ETO-supply chain characteristics, Norwegian yards and systems theory is described and assessed. Here, the Viable Systems Model (VSM) used for analysing the Group is thoroughly explained. After that, Chapter 3 provides the research approach to study the focal company. In Chapter 4, the initial steps of a viable systems analysis is applied to the Group. Here, a ”purpose to be pursued” which will guide the analysis, is presented. The analysis of the organisation system is completed in Chapter 5, and discussed in Chapter 6. Chapter 7 concludes on the overall problem statement of this thesis.

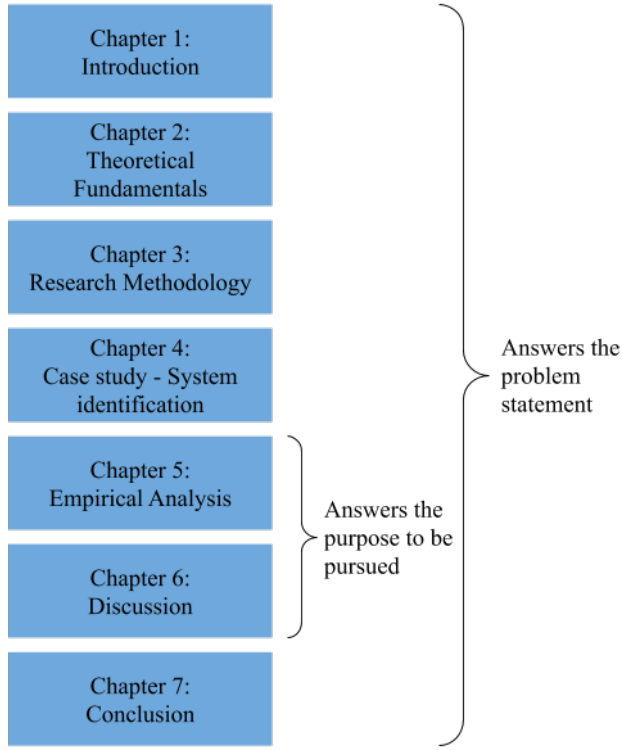

Figure 1.1: The structure of the thesis

Chapter 2

Theoretical fundamentals

In the beginning of this chapter, literature on supply chain management in engineer-to-order supply chains is reviewed. Through the review, it becomes evident that there is a lack of research on highly complex ETO industries. This argues that there is a need for adding a systemic perspective to the existing research. The review also gives an understanding of the context where principles of a viable system have been applied, particularly for Norwegian shipyards, where the projects have become more complex than ever before. Then the theoretical foundations on systems thinking is presented, with a special focus on the Viable Systems Model.

2.1 Supply chains in Norwegian shipbuilding companies

Mello and Strandhagen (2011) state that one of the main challenges shipbuilding companies face is how to manage the activities performed by a worldwide network of suppliers. In the recent years, the shipbuilding community has become increasingly aware of the significance of efficiently performing, coordinating and integrating such activities (Semini et al., 2014). According to Semini et al. (2014), most shipbuilders operate with an ETO supply chain. Procurement has gained attention in the literature as one of the most important functions in modern shipyards (Hagen and Erikstad, 2014). Therefore, supply chains in an ETO setting will be further elaborated on in this chapter. There are several characteristics of the Norwegian shipyards that distinguish them from larger shipbuilding companies and yards of similar size in low-cost countries, and these will also be further explored in this chapter. Firstly, theory on ETO supply chains is presented. Then the importance of supply chain coordination in shipbuilding is highlighted. Lastly, there is a more in-depth description of Norwegian shipyards.

2.1.1 Engineer-to-order supply chains

There is no broadly agreed-upon definition of ETO in the literature (Gosling and Naim, 2009). However, the customer order decoupling point (CODP) is generally regarded as a good way of defining what separates the ETO strategy from other strategies (Gosling and Naim, 2009; Haug, Ladeby, and Edwards, 2009). The CODP describes "how deep the customer order penetrates the firm's material flow" (Van Weele, 2018, p. 260). According to Olhager (2003), four different supply chain structures can be identified based on the CODP. With make-to-stock (MTS) the CODP is located at the shipment phase, meaning that the customer has little possibility to influence the product. Engineer-to-order (ETO) is found on the other end of this scale. With ETO, the decoupling happens around the design stage, and the product is engineered to meet the requirements of the customer. Norwegian shipbuilding production and design/engineering activities are characterised by high complexity and low volumes (Hagen and Erikstad, 2014). The ships are usually customised, with unique designs for every project. Most Norwegian yards would therefore be situated at the ETO stage. The ETO supply chain is usually project-based, with raw materials and parts being sourced after the customer order is received (Gosling and Naim, 2009).

According to Hicks et al. (2000), in contrast to the high volume sectors, limited research is done on low volume ETO sectors. That is despite the fact that customisation has been considered to be a way of gaining competitive advantage (Amaro et al., 1999; Lampel and Mintzberg, 1996). Gosling and Naim (2009) confirm that this was still true in 2009, as strategies for ETO companies that operate in environments defined by being highly customised and low volume have received far less attention than the standardised, high volume research area. On the other hand, Zennaro et al. (2019) conclude that during the last decade, production processes for "big size products" have received more academic attention than before, including shipbuilding. This might be explained by Johnsen and Hvam (2019), who recognise that there has been a growth in customer expectations and demands, resulting in a need for operating strategies that better support product customisation. This calls for more use of ETO strategies. Zennaro et al. (2019) point at several areas that need to be further investigated, indicating that much of the research area is still uncharted territory. Mello and Strandhagen (2011) point out that findings from high volume research are not always applicable to low volume industries like shipbuilding. It is clear that the field needs to be considered from several perspectives. VSM offers a different way of analysing ETO companies, and can attribute to the lack of research on ETO supply chains.

2.1.2 Supply chain coordination in ETO

Christopher (2016) states that we are entering an era of "network competition", where an efficient structure, coordination, and management of network relationships is needed to deliver superior value. That is supported by Hagen and Erikstad (2014), who claim that today's competition is between supply chains rather than companies. "Network competition" is highly relevant for the shipbuilding industry, as yards have emerged from being more or less self-sustained production sites to becoming assembly yards, and a part of a larger value chain. The modern shipyard has become a main hub in a value network, and

it is said that the most successful yards are those that best exploit the core competency of each actor in this network (Hagen and Erikstad, 2014). This transition comes from the increased outsourcing of activities, with implications for reducing costs, increasing the ability to innovate, and responding quickly to market changes (Mello and Strandhagen, 2011). Consequently, a high share of the total cost is related to external deliveries and value-adding from suppliers. With such a high share of external resources, modern shipbuilding is essentially about having competent people with proper tools to treat and assemble material and components from numerous sources, in such a way that the total production cost is reduced. Integration and coordination has become increasingly important to manage this and achieve high performance (Fleischer et al., 1998). The success of implementing a shipbuilding network depends on the ability to manage the supply chain (Mello and Strandhagen, 2011). To efficiently manage the supply chain, all parts of the chain needs to be considered in coherence, to ensure system-wide optimal operations. This is where VSM provides a powerful tool to view the operations in a holistic manner, and also to help visualise the complex flow of information and material in the organisation. Having competent people with the proper tools to assemble components from numerous sources is insufficient if it becomes evident that the organisational structure in a shipbuilding company hampers efficient project management. This management is becoming increasingly complex for Norwegian yards, due to the characteristics of their environmental context. This is further assessed in the next section.

2.1.3 Norwegian yards

Most Norwegian yards are characterised as small compared to the world standard (Semini et al., 2018). The workforce is highly skilled and experienced. There is a wide knowledge base, especially in regards to the production of advanced and complex ships. The expertise is acquired through years of experience with shipbuilding. Norwegian yards outsource most of the work related to building of the hull and production of specialised systems and specialise in designing, installing, inspecting, and testing, as this is where the highest margins are (Ulstein and Brett, 2009). The yards are often located in fjords and districts with proximity to deep seas.

Norwegian shipyards have traditionally produced highly customised and advanced ships, almost prototypes (Semini et al., 2014), and are known to produce vessels of excellent quality. These types of ships are usually only produced as a one-off or in small series, and it is rare to completely reuse old drawings and plans in the production of new ships. That creates considerable challenges in regards to suppliers and coordination, as there is no routine in planning and delivery. It increases the share of the total cost related to external deliveries, and the level of information, actors, and material that needs to be managed.

Norwegian yards have limited capacity to produce and many of them complete only around one to two projects annually (Semini et al., 2014). This represents a low volume compared to many competing foreign yards. That can be attributed to the capacity restrictions of the yard, market demand, financial strength and how time demanding the complexity of ships makes every project. It also entails that the yards have an unsteady and low demand

towards their suppliers. That affects the yard's purchasing power, often making the yards more depending on their supplier. On the other extreme are some Asian yards, that due to larger volumes have integrated the production of larger equipment in-house. Larger yards benefit from economies of scale and may have more purchasing power, enabling them to source from many different suppliers which most Norwegian yards are not large enough to be able to do.

Traditionally, one key feature of the competitiveness of the Norwegian maritime industry is that there exists a cluster in Western-Norway of tightly integrated world-class companies in each step of the value chain (Menon, 2019a). Clusters have been defined by Porter et al. (1998) as "geographic concentrations of interconnected companies and institutions in a particular field". They argue that clusters are an important part of the competitive advantage of nations. Porter et al. (1998) also state that clusters can lead to increased productivity within participating companies.

The cluster provides access to some of the top suppliers of equipment, ship design offices and largest offshore fleet owners in the world. Therefore, Norwegian yards are still competitive on an international level despite high wages and far distances to many customers and suppliers (Semini et al., 2018). Norway is one of the more complete maritime cluster nations, in league with Germany and Japan (Hagen and Erikstad, 2014).

Despite of the benefits of the cluster, there is currently a productivity gap between the Møre cluster and the national benchmark, meaning that the cluster's accumulated performance is not as strong as the Norwegian average (Menon, 2019a). Both the productivity and profitability challenges the yards are facing today is argued to be closely related to ripple effects of the financial crisis of 2008 and the decline in the offshore markets in 2014. Still, a lot can also be related to the challenges in facing new value chains and learning curves as they have entered completely new markets. With footing in the productivity and profitability challenge among Norwegian yards, and their complex day-to-day operations as outlined in the sections above, a theoretical approach is needed to fully understand these challenges. In the next section, the theoretical fundamentals of systems thinking as a problem-solving approach is presented.

2.2 System view

As many modern-day problems tend to be complex, researchers have in the recent years emphasised to consider the wider consequences of actions and interventions in managerial decisions. This comes as a reaction to the more traditional reductionist problem-solving approach, where problems are divided into parts to make them more manageable (Peter et al., 1990). The systems view provides a more holistic approach to problem-solving, and has gained attention among researchers through the years. Hence, many descriptions, theories, frameworks and tools exist in the world of systems theory. The following sections will try to grasp the most important parts of systems thinking to provide the reader with the necessary foundation to understand the principles applied to the focal company in this thesis. It is therefore chosen to emphasise what defines a system, a brief history on how the

systems theory has developed, and an extensive description of the system theory applied in this thesis, namely the Viable System Model.

2.2.1 Defining a system

Within organisational theory, the systems have been given several definitions. Common for them all is that they refer to the system as something with defined boundaries, an entity made up of smaller parts. The concept of a system has been understood since the early part of the twentieth century as a collection of interrelated parts with a purpose that work together to create a coherent whole (Espinosa et al., 2011). Checkland (1981) describes the system as something more than the sum of its parts. This indicates that a system has synergy or emergent behaviour. Leonard and Beer (1994) view a system as an entity that has interacting parts and that operates in an environment, and add the following remark:

> ”A system does not exist until it has been specified by an observer who defines this system and establishes its boundaries according to some purpose or set of criteria” (p. 4)

Through this they explain how a system does not really exist in a physical sense, but rather in the mind of the observer.

2.2.2 The history of general systems theory

VSM has its origin in the field of general systems theory. This is a large and complicated topic. The following sections attempt to give the reader an overview of important historical developments within systems theory. This is in no way a complete summary of the topic, but highlights important managerial and organisational developments relevant to the case company.

The earliest development of general systems theory (GST) can be traced back to 1912 and Alexander Bogdanov, who anticipated several of the themes that can be linked to the general systems theory we know today (Jackson, 2019). Ludwig von Bertalanffy 1937 was one of the first to express the need for a general systems theory. von Bertalanffy (1971, p.36) argued that GST is a general science of ”wholeness”. This refers to how systems have strongly interrelated entities who’s interaction is non-linear, better known as ”the whole is more than the sum of its parts”. It is clear that von Bertalanffy drew inspiration from the field of biology, as many system thinkers also have done after him.

In the book General System Theory (1971, p. 37) von Bertalanffy explains the aims of GST: There is a need to integrate various sciences, both natural and social, in such a way that science can become more unified. He rejected the popular reductionist method in favour of a more holistic approach to complex problem solving. The reductionist method was the established way to deal issues within management. Reductionism sees the whole as the sum of a minimal number of parts. It deals with these parts in isolation, and often

combines just a few elements at the time to evaluate the effect they have on each other. This way of looking at systems can be useful when the problem at hand is well defined, but in today's organisations many problems tend to be complex (Leonard and Beer, 1994). Many science disciplines have more difficulties communicating with each other the more specialised they become (Jackson, 2019). GST can in many ways be seen as a response to reductionism, and adds to the multitude of systems researchers that have developed definitions and descriptions of system thinking to confront the drawbacks of reductionism. To mention one of the researchers that has influenced the mindset in the wide field of systems theories, the work of Emery (1969) is pointed out. He introduced the idea of viewing living systems as open systems, "open to matter-energy exchanges with an environment" '(Emery, 1969, p. 8). This expands the thought on viewing entities as a part of a wider system, to also include the systems interactions with the environment. According to Leonard and Beer (1994), it is the exchanges with the environment that enables the continued existence of the system. This underpins the importance of characterising the environment surrounding the system in focus, and the communication between. An important part of applying systems theories to managerial problem solving, is to identify the systems boundaries. Both Emery (1969) and Mele et al. (2010) argue that controlling the boundary conditions is the responsibility of the management, which is important for a system to properly adapt to the environment.

These different developments by various systems researchers partly shows the magnitude of theories and methods suggested for complex problem solving. Viewing organisations as systems has become a large field of study. In his book General System Theory (1971, p.21) von Bertalanffy considers cybernetics to be "special case" of GST, as there are many parallels, but GST is broader in its scope. Cybernetics is another additional sub-field of systems theory that has a detailed history with many turns and trends, which is not expedient to dive into here. But this scientific study on how humans, animals and machines control and communicate with each other is important to mention, as the principles that underpins the systems theory applied in this thesis is of cybernetic nature. It was one of the pioneers within cybernetics, Norbert Wiener, that first defined cybernetics as "the study of control and communication in the animal and the machine" in his book Cybernetics (1948). Stafford Beer adopts the principles of cybernetics to the management of an effective organisation, and introduces VSM in his books Brain of the Firm (1972) and Heart of the Enterprise (1979). With a cybernetic origin, the viable systems theory is full of both mathematical and managerial nuances. As for the application in this thesis, the managerial approach is deemed most important, and we will hence steer away from comprehensive description of cybernetic principles. It is rather focused on the practical application of VSM as a robust analytical framework and diagnosis tool for complex problem solving. This narrows down the theoretical fundamentals to focus on one of the methods within the wide field of systems theories, namely VSM.

2.2.3 VSM

The origin of VSM dates back to the 1950's. The model came into existence when Stafford Beer applied both cybernetics and operational research to a case in the steel industry in the

UK. His model builds on the work of several researchers. Warren McCulloch (1943) and his work with neural nets, as well as Ross Ashby (1956) and his findings relating to requisite variety, and Norbert Wieners cybernetic research, were all important. VSM is a neurocybernetic model, meaning that it draws inspiration from research done on the nervous system of the body and especially the brain (Leonard and Beer, 1994). The VSM is thus grounded in system thinking and cybernetics (Leonard, 2006). When considering industrial operations, Beer drew parallels to the body, which he considered to be a perfect example of a viable system (Leonard, 2009). Through his books "Brain of the firm", "Heart of the Enterprise" and "Diagnosing the system - for organisations", Beer has developed and described the model he created. These books lay the foundation for the way VSM is used today.

A definition of a viable system is that it has the ability to maintain a separate existence (Espejo, 2003). In order to be viable, these systems need to have the capacity to respond to both expected and unexpected events that occur in their environment. For a shipbuilding company, this means that they must be able to handle both well-known events like a tendering process, but also unpredictable happenings like drastic changes in market demands. These types of events may shift the system out of balance for a while, but a truly viable system has the ability to bounce back, adapting to the change. It is assumed that viability is a goal for all organisations (Leonard and Beer, 1994).

The VSM model is used to both diagnose and design the organisational construction and communications setup (Leonard and Beer, 1994). It focuses on organisation rather than structure (Flood et al., 1991), and therefore provides a new approach to considering organisational issues. It helps to understand how the structural context, often referred to as the "shared communication spaces" can hinder good communication between people. This is done by building a picture of how the system is organised today and compare it against the ideal VSM structure (Flood, 1995). This visualisation of the organisation makes it possible to identify and assess risks related to performance problems and unintended consequences, and ameliorate them (Espejo, 2003). Espejo (2003) states that:

> "VSM is above all about connectivity, about structuring the system to facilitate healthy growth of effective relationships."

In addition to being recognised as a powerful tool to understand, diagnose and redesign organisations, it can also facilitate change management, and has been well recognise for this (Espejo and Gill, 1997).

The significance of VSM in the field of operational management is evident (Jackson, 1988), and it has also been applied to a broad variety of cases, reaching from bee colonies to government organisations like the Chilean social economy (Leonard & Beer, 1994). All these applications shows the versatility of the VSM, and the system theory is acknowledged by both consultants, system analysts and managers for its ability to deal with complex management (Jackson, 1988; Snowdon and Kawalek, 2003; Devine, 2005).

The viable system model in itself differentiates between five functions. These are argued to be necessary for a company to remain viable. They are referred to as "systems", and are

distinguished by certain features. The information and communication that flows between these vital functions are also considered, as these need to be managed according to the amount of information that flows in the organisation. Each function and communication channel will be explained in more detail in Section 2.2.5. First, the underlying principles of the VSM will be elaborated on, as these serve as basis for understanding how the different functions should be managed to ensure organisational coherence.

2.2.4 Basic principles of the VSM

VSM is grounded in several principals such as Ashby's law of requisite variety, variety engineering, recursion and local autonomy. These will be briefly presented in the following sections.

Ashby's law of requisite variety
Within cybernetics, the number of distinguishable items or states is referred to as the "variety" (Beer, 1972). Beer (1972, p.11) explains Ashby's law in the following way: "Only variety can absorb variety". Put differently, this means that the controller of a system can only have control if the variety of the controller is as large as the variety of the system he is controlling (Beer, 1972). Thus, the internal variety of the system must be increased to, and the external variety of the environment reduced to, a level where they match each other (Leonard, 2006). This law explains how systems can sustain their stability over time. It can be exemplified through the action of driving a car (Espejo, 2003). You can keep the car on the road by responding to the turns that you meet on the way. More specifically, this is done through you turning the steering wheel and adjusting speed. If you can manage this, you have enough requisite variety to keep the car on the road. The disturbances on the road represent external variety, while your driving skills represent internal variety. Thus, you have enough internal variety to absorb the external variety brought upon you from the environment. The variety of the controller must therefore be greater or equal to that which is being controlled (Flood et al., 1991, p. 90). The VSM is designed so that a system can have requisite variety by dealing with variety with its capacity of internal collaboration, and a coherent treatment of the organisation's environment (Espejo, 2003). In a shipbuilding context, this can for example be related to the internal collaboration between the engineering and production department to control the external variety imposed by change orders, which is typical in shipbuilding projects. As engineering and production also is done concurrently in some projects, the complexity in controlling this variety is increased.

Variety engineering
From Ashby's law of requisite variety it can be understood that the act of balancing inner and outer variety is important. This is done through variety engineering, which uses amplifiers and transducers to increase or reduce the variety (Beer, 1984). Transducers can for example be coordination mechanisms between the functions of an organisation that helps dampen the variety oscillations. In a shipbuilding project, this could be the weekly meetings a project team holds for technical line managers from different departments, where it is ensured that information is adequately transferred in the organisation.

Recursion
VSM is built on recursive system theory, and it views organisations in a different manner than what is done in traditional management theory (Espejo and Gill, 1997). This entails that a viable system contains less comprehensive viable systems, at the same time as it is contained within more comprehensive viable systems (Espinosa and Walker, 2006). Beer (1984) states that the traditional way of looking at an organisation is only useful when appointing blame. In stead of considering organisations in a hierarchical way with a top-down view, they are seen as recursions of systems in the VSM. Beer (1984) compares the recursion of systems in VSM to Russian dolls. The systems are nested in each other, and are structured in a similar way. The whole system is then replicated in the parts of the system, meaning that VSM can be used to model all parts of the organisation (Flood et al., 1991). The viable organisation is comprised by autonomous units within other autonomous units (Schwaninger, 2006). This means that the complexity that challenges a whole organisation can be tackled by spreading it across various recursive levels (Schuhmann, 1990). This can be done due to the principle of local autonomy, which will be further explained in the next section.

Autonomy
A central principle of the VSM is autonomy. The lower level units in the recursive system have a certain degree of autonomy, which allows for dealing with problems at a local level, in stead of having to involve upper management (Hildbrand and Bodhanya, 2015). This allows the lower units to work towards their environment freely as long as their actions do not affect the overall unity of the organisation (Schwaninger, 2006). The aim of ensuring organisational cohesion is a challenging trade-off when granting the operational units more local autonomy (Espejo, 2003).

2.2.5 The viable systems model: Three elements, five systems and the communication within

The model that according to Beer constitutes a self-organising system contains three main elements, namely:

The operations - where service or products are developed
The environment - the socio-ecological context where the organisation operates
The meta-systemic management - management and technical support to operations

Within these three elements there are five management functions (S1-S5) which are argued to be necessary for an organisation to have high operational effectiveness within its environment and maintain its identity. In addition to the five management functions, the VSM consists of vertical and horizontal communication lines between the functions. In the following sections, each function will be described, finishing off with the communication channels that connect these functions and the importance of this. The figure below illus-

trates the generic VSM, where the information channels between the different functions are outlined:

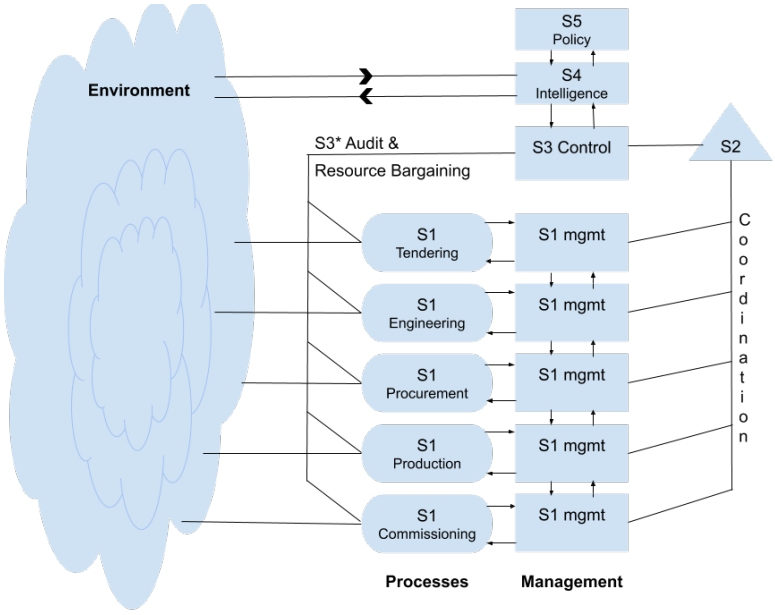

Figure 2.1: A generic VSM

System 1: Operations

System 1 (S1) constitutes the day-to-day activities that are creating value in the organisation. These activities are categorised into the main processes and connected to their management, which has expertise knowledge about the division's capacities and market requirements (Leonard and Beer, 1994). Each process interacts with their local environment, and should thus be as free as possible to deal with their environments as well (Hildbrand and Bodhanya, 2015; Azadeh et al., 2012). They should therefore be designed in a way that they are granted enough autonomy to carry out day-to-day activities to adapt to the environment, without compromising overall coherence with the system (Espinosa et al., 2011; Hildbrand and Bodhanya, 2015). Granting autonomy to System 1 is actually the basis of variety engineering (Azadeh et al., 2012). When the S1 units have local autonomy, environment variety can be absorbed by them, and the management will have less inflow variety to control.

It is important to describe S1 operations as correct as possible, so that their descriptions are logical at the level of recursion that is being diagnosed. Each process should be at the same level of recursion, so they can be compared against other levels (Leonard and Beer, 1994). For instance, "Production" in a shipbuilding project is a process that holds additional sub-processes at a lower level of recursion, illustrated in Figure 2.2:

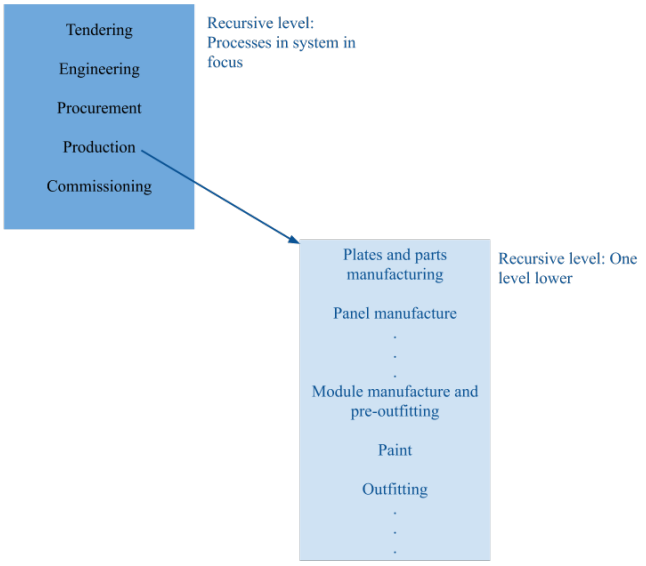

Figure 2.2: Processes at different levels of recursion

For a company to remain viable, each of these sub-processes need to have their own management and control functions, and can thus also be the system in focus for a VSM diagnosis. At any level of recursion, it can be difficult to define the core processes for an organisation. This is especially true for service companies. Representation criteria for processes is therefore suggested to be either geography, activity type, resources required or clients served (Leonard and Beer, 1994).

System 2: Co-ordination

System 2 (S2) fulfils the coordination function of the system. It co-ordinates the parts that make up S1 in a harmonious manner, and dampens the uncontrolled oscillations between them (Flood and Jackson, 1991). This is done by receiving information about short-term challenges in S1, and through given procedures these challenges are controlled and optimal resource allocation can be secured (Flood, 1995). Such procedures can for example be weekly status meetings on a project where representatives from the different S1 units meet. A scheduling system can also constitute as an example of S2 (Hildbrand and Bodhanya, 2015).

System 3: Control

System 3 (S3) is a control function that ultimately maintains the internal stability (Flood and Jackson, 1991). It manages the operational units by engaging in resource bargaining and executing corporate instructions and controls (Hildbrand and Bodhanya, 2015). By doing this, the system ensures effective implementation of policy (Flood and Jackson,

1991). S3 carries out ”audits” using the System 3* (S3*) auditing channel. Leonard (2009) argues that resource bargaining through the S3* channel is also needed to facilitate running of the organisation in the best interest of the whole, and not solely according to the individual needs of S1 units.

System 3*: Audit and Resource Bargaining

S3* supports S3 in its control function through audits, such as for example budget reviews, IT audits or any form of audit relevant to the viability of the organisation. It sporadically monitors variables that are not covered by normal S3 and S2 controls (Hildbrand and Bodhanya, 2015). In this way, the need for looking deeper into S1 is covered. With feedback from S3*, S3 can intervene “to re-orient behaviours that may threaten organisational viability or sustainability” (Espejo and Espinosa, 2015, p. 957).

System 4: Intelligence

System 4 (S4) is an intelligence gathering and reporting function that captures all relevant information about a system’s total environment (Flood and Jackson, 1991). To do this, it explores external trends and possible future threats and opportunities, and the information is brought together in an ”operations room” - an environment for decision-making (Flood and Jackson, 1991; Tejeida-Padilla et al., 2010). The demands of S3 and S4 have to be balanced to ensure that the system is able to continue with its current operations, while preparing for future developments (Bustard et al., 2006). S4 distributes environmental information upwards and downwards according to its degree of importance, and rapidly transmits urgent information from Systems 1, 2 and 3 to System 5 (Flood and Jackson, 1991). This function could be a role of an R&D-department, and typical intelligence activities are forward planning, forecasting, marketing, and technical/product development (Hildbrand and Bodhanya, 2015; Hoverstadt and Bowling, 2005).

System 5: Policy

System 5 (S5) responds to significant signals that pass through the various ”filters” of Systems 1, 2, 3 and 4. It deals with the strategic decisions and modifies policies based on the relevant information that reaches it after it has been filtered (Leonard, 2009). It defines the organisations mission, goals, objectives values and culture and presents the system to the environment. It is generally defined by high-level management. However, it is stressed that all recursive levels contribute to S5 and that VSM is far from a hierarchical top-down approach (Hildbrand and Bodhanya, 2015; Espejo and Gill, 1997).

Information flows

Appropriate information flows and communication links are also important in the VSM. These channels can tell much about the organisation’s effectiveness. Diagnosing the organisation and summing it up in a VSM can create a powerful picture showing that the structure is worked out in a manner that opposes the principles of viability (Beer, 1974). This may either be that the information flows supporting viability are weak, missing completely or that the organisation is structured in a way such that unnecessary information

flows in the organisation and cannot be handled by the existing channels. This is a sign that greater autonomy should be assigned to the particular units.

The VSM is composed of six communication channels. The goal of the channels are to support communication and interaction between the different subsystems, as well as coordination and control (Jackson, 1988). There is also a two-way communication towards the environment (Beer, 1985). The figure below outlines the different channels:

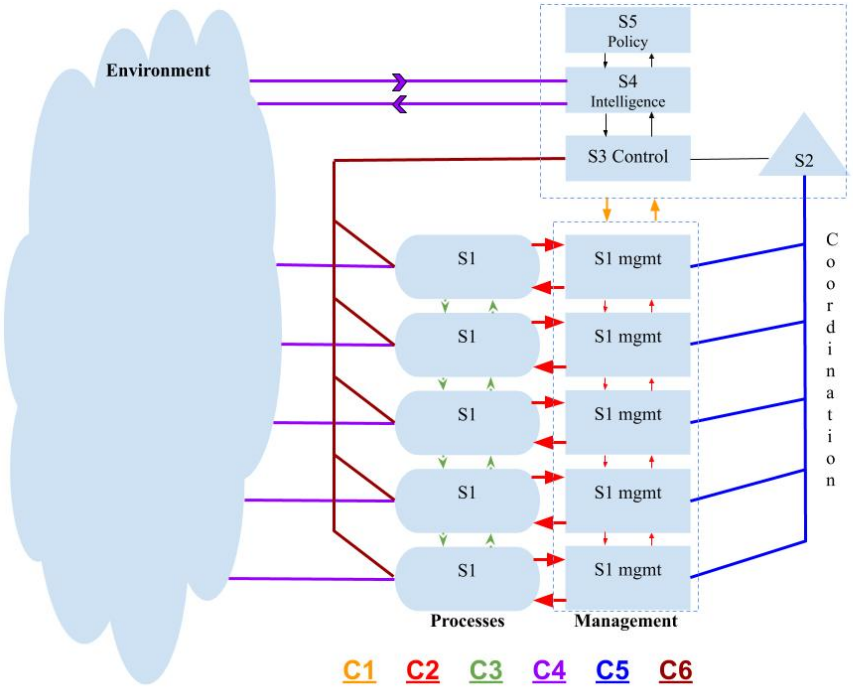

Figure 2.3: The VSM and the channels connecting the subsystems (Adapted from Hildbrand and Bodhanya (2015)

Objectives for the different channels are accordingly:

Channel	Objective
C1	Facilitates transmission of instructions and corporate standards from the meta-system to the operative management
C2	Used for resource provision and resource bargaining between the operational units and the management for accountability purposes
C3	Facilitates communication between the operational units
C4	Responsible for communications in the environment and facilitates environmental communication for the operational units
C5	Supports coordination processes by connecting S2 to the operational units and their management
C6	Provides S3* direct access to the operational units

Table 2.1: Communication channels

Frequent faults found when diagnosing the information channels, transducers and control loops of a VSM are that the communication channels in the organisation and between the organisation and the environment do not correspond to the information flows said to be necessary in any viable system. It is also revealed that transmission of performance indices is often not rapid enough (Flood and Jackson, 1991). For an organisation to be sustainable and competitive, it is important that these faults are avoided, and that the communication channels and information flows are well-functioning, organised and managed (Mele et al., 2010).

Chapter 3

Research Methodology

In this chapter, the research methodology for the empirical study is presented and evaluated in relation to its applicability for this study. The chapter is structured into three parts: research design, research strategy, and research method. The choices made about research approaches are strongly guided by the theories behind the VSM, and its practical application. This chapter will, hence, focus on how the VSM-designed research compares with suggested social research methods to study the problem statement of this thesis.

3.1 Research Design

To best answer the problem statement of this thesis, how Norwegian yards can become more viable in increasingly complex markets, a suitable research design must be chosen. Meredith (1998) argues that in general, case and field studies are preferred for building new knowledge within operations management when compared to the more traditional rationalist methods like optimisation, simulation, and statistical modelling. These methods usually fail to analyse and document complex problems by focusing on one specific element of the system or oversimplifying a problem situation (Mello, 2015). The need for a research design with a holistic approach to gain knowledge in operations management is thus in accordance with the goal of a VSM; developing an extensive picture of the case system (Flood and Ulrich, 1990). Due to our limited time scope, it was chosen to conduct a single case study. In this way, we aim at gaining sufficient depth of the problems occurring at one specific company. The single case study is also defined as explanatory, as it seeks to explain an expected causality within a context that is so complex that an experiment or survey can not uncover the expected causality (Yin, 2017). We argue that the case study is not only explanatory, as it also has an exploratory motive. This VSM diagnosis is, to the best of our knowledge, of the first kind done in this type of industry. The approaches are therefor overlapping, but the explanatory method is seen as most advantageous when explaining complex and entangled situations.

Yin (2017) defines case studies as being able to cope with the situation in which there will be many more variables of interest than data points. This means that one must draw the same conclusions based on data from many different sources. The case study will therefore take advantage of developed theory suggestions that can guide the data collection and analysis (Yin, 2017; Dubois and Gadde, 2002). This is where theory on viable systems prevails itself as an excellent tool help guide the research. The case study is in itself the process of describing how the focal company is organised as a viable system. Through the data collection we diagnose how variety is controlled. With variety engineering in mind, it may become evident through the data collection that there exists a variety unbalance in the system, reducing the viability of the company. Based on this, suggestions on how to restructure the company can be made. To reach these conclusions, the research will follow the steps in 'Viable System Diagosis' (VSD) suggested by Flood and Jackson (1991). This also guides how the empirical analysis is structured in the following chapters. Flood and Jackson (1991) divided the process into two parts: system identification and system diagnosis:

System identification
1) Identify the purpose to be pursued
2) Determine the system that is in focus
3) Specify viable parts of the System 1 of the system in focus
4) Specify the viable system of which the system in focus is part

Table 3.1: The processes of a identifying the system, adapted from Flood and Jackson (1991, p.94).

System diagnosis	
System 1	Detail the environment, operations and management Study constraints imposed on each part of S1 by higher management Ask how accountability is exercised
System 2	Identify possible sources of oscillation and conflict Identify what might have a dampening effect Identify how S2 is perceived in the organisation
System 3	Identify S3 components Ask how they exercise authority Ask how resource bargaining is carried out Identify who is responsible for the performance parts of S1 Clarify audit enquiries S3 conducts
System 4	Identify all activities of S4, and how far ahead these are considered Determine if S4 is monitoring the environment and trends Find out if S4 provides an operations room for collecting information Find out if S4 is able to alert S5 of urgent developments
System 5	Ask who is on ”the board”, and how it acts Ask if S5 provides an identity for the system Ask if ethos set by S5 affects how S4 is perceived Identify if S5 shares identity with S1 and the other systems
Information and communication flows	Check that all information channels, transducers and control loops are properly designed

Table 3.2: The processes of a Viable Systems Diagnosis, adapted from Flood and Jackson (1991, p.94-95)

An important principle when applying the VSM is that discussion and interaction should not only happen based on a finished VSM, but also during the process of generating the VSM. By our understanding, there seems to be a lot to learn just by outlining which subsidiaries that constitutes the different systems of an umbrella company, if the system in focus is an actual organisation. This makes the initial video call meetings with company representatives equally important data basis as the conducted interviews. How data for pursuing the different steps is collected is more thoroughly described later in research method. First, the chosen research strategy in the single case study is presented in the next section.

3.2 Research Strategy

Inductive approach
There are primarily three types of logics for building arguments in operations management research: induction, deduction and abduction (Karlsson, 2010). According to Bryman (2016), the inductive approach starts with empirical observations and proposes theories at the end of the process as an outcome of the study. As the problem statement of this thesis has its footing in observations of real problems at shipyards, an inductive logic is adopted.

Vik (2018) supports that inductive strategies of linking data to theory are typical for qualitative research, but choosing a coherent strategy is not as clear-cut as it seems. Sometimes a study ends up applying a more iterative approach: weaving back and forth between data and theory. As the VSM theory acts as a guiding framework for collecting and analysing data throughout the whole research in this thesis, it is argued that the inductive approach is pursued closely.

Qualitative approach
Another common decision in research is the choice between doing a qualitative or quantitative study. A qualitative research opens up to study questions in depth and find the underlying causes to problems as it outlines the specific rather than the general (Bryman, 2016). The causes of hindrances in efficient management of ETO supply chains are complex to describe. Adoption of a qualitative strategy is thus recommended by Creswell and Poth (2016), as a complex, detailed understanding of the problem is needed in this case. Qualitative research techniques are also proposed by Hildbrand and Bodhanya (2015) to be used for a VSM diagnosis. The resulting research method is therefore in accordance with how the VSM is designed, which aims to qualitatively express how an organisation is structured and how the information flows. It is challenging to quantitatively measure the performance related to how a company is organised, and this is where the qualitative approach of the VSM comes in as a useful tool to describe and diagnose the performance of an organisation's structure.

3.3 Research Method

The Covid-19 situation has affected the data collection of this thesis. This will be elaborated on further later in this chapter. Therefor, a series of initial video call meetings with company representatives became an important source of data. They helped us to identify which departments of the different subsidiaries in the Group could be linked to the different functions of a VSM. A good case description could then be established, which is emphasised by Eisenhardt (1989) to be important for gaining insight into a case and to simplify the data analysis. This was found to be especially true when conducting the VSM diagnosis, as the description of how the case company was structured according to a viable system helped us develop a thorough interview guide. Involving company representatives was also a way to make sure that the VSM is being used according to its original intention and not reflecting the perception of reality of the modeller (Creswell and Poth, 2016). This reduces the lack of subjective interpretations, which Leonard and Beer (1994) claim that some criticise the VSM for missing when constructing a picture of a system.

The set of interviews following the initial video call meetings became the main technique for collecting data in this research. It was important to make sure that we covered all topics of the VSM, so it could be modelled correctly. This is possible through semi-structured interviews, as we are sure to touch on every aspect of the VSM, but allowing for more detailed information on what the subject finds important. In addition, semi-structured interviews were used as it was necessary to compare how people in different positions of the company see the system they work in. By making sure that stakeholders in different

positions are heard and their view is accounted for, we can make sure that the model is formed in the view of the people involved, and not in the view of the VSM modeller. Therefore it is important to engage with representatives from several different stakeholder groups to collect sufficient information (Hildbrand and Bodhanya, 2015). Ideally, one should involve all the different stakeholders, but this is practically challenging, especially during the Covid-19 situation. The informants we interviewed included both workers with leadership responsibilities and people with less decision-making power, and they were all asked the same questions regardless of their status. The amount of interviews required for a VSM diagnosis cannot be predetermined, but depends on how much information the different interviewees can provide. As long as the five subsystems and six channels are not clearly defined, the interview process needs to continue (Hildbrand and Bodhanya, 2015). This was the case for our interviews as well. We conducted interviews and asked to talk to different representatives, but also customers and suppliers, until we felt that we had reached a satisfactory level in regards to the amount of empiricism. This resulted in seven interviews structured to fill in on the VSM, and several meetings with our main company representative both before, during and especially after the data collection. Ideally, we would want to interview enough people to be able to confirm our some of our findings through cross-referencing. Due to Covid-19, this proved to be difficult. We have however collected enough data to complete the VSM analysis. The information level is deemed satisfactory. The following table provides an overview of the interviews we were able to conduct:

Type of meeting	Responsibility area of company representative
Initial meetings	Business development
Semi-structured interview	Sales
Semi-structured interview	Supply chain
Semi-structured interview	Project management
Semi -structured interview	Procurement
Semi-structured interview	Business development
Focused interview	Supplier of propulsion systems
Focused interview	Customer
Feedback session on findings	Business development

Table 3.3: Conducted interviews

The questions in the interview guide were designed in line with Bryman's (2016) recommendations. This includes introductory, follow-up, in-depth, specifying, direct, indirect, structuring and interpretive questions, as well as the use of silence to allow the informant to reflect or elaborate their answers (Bryman, 2016). Based on knowing how different entities in the Group could be assigned to the different systems in a VSM, ideas on how variety may be unbalanced in the system appeared, and questions aimed at uncovering this were asked. Imagining the information and the material flows horizontally and vertically in the VSM, and how the communication is coordinated between the entities helped to develop the interview guide. Consequently, the questions were structured based on the parts of the VSM model, categorised after the different systems (S1-S5) and the information flow. The

questions aimed at providing data that helps diagnosing how variety is engineered in and between the different systems, looking for variety unbalance that needed re-engineering. Developing questions assigned to the different functions of a viable system made us realise how efficient it was to use VSM as a framework for designing our research. At the same time, we are aware of the limitations of both the VSM and interviewing as a methodology. Flood and Jackson (1991) recognise that the VSM says little about the social, cultural and political processes that go on in the organisation. As researchers it is important that we are attentive to this as we try to paint a complete picture of the organisation. We payed attention to this challenge throughout the interviews. The interview guide that we used can be found in Appendix I.

This has been a two-step approach. First, a number of employees were interviewed. After the interviews had been analysed, two company representatives were once again contacted for a feedback session. The analysing has been a heuristic process, where information from the feedback session has led to new realisations in the analysis, and has been added subsequently to make the analysis as accurate as possible.

3.4 Data analysis

As the VSM was used to guide the interviews, it also became the framework for how the data and information was analysed. Each interview was conducted in Norwegian and then meticulously transcribed. We will therefore only include the English version of the quotes. As the questions were structured according to the different systems, the empiricism could be easily coded separately into themes using the computer program Excel. For each interview, all empiricism was coded and colour coded based on the different systems. The colour coding was only used for visualisation purposes when going through a large amount of material. In the next column, a theme was given to the material. Then, a column was dedicated to the raw material, and in the last column, comments on the material could be made. An example of how this looks in Excel is given below. A more readable version can be found in Appendix II.

Sorting code	SDI code	Interview	Comment
S1 - Operations	A normal working day	When you are a sales manager, your day depends a bit which phone call you get in the morning. Normally we travel a lot and visit customers, but that is difficult in these days. The day can entail anything from working on a sales project, depending on where we are in the project, the work is very different. In some projects we are just discussing with the customer over the phone, while in others, we have full project teams that are working with calculations. For me it is important to stay updated and understand what is going on, and who is doing what.	Can be useful in chapter 5
Information flows	Communication tools between functions and the environment	Normally we sit in neighbouring offices, so that is not a problem. But the way that the situation is now, we have used Microsoft Teams quite a lot, which works very well. We also use share-point. We have all the tools that Microsoft deliver, and we use these quite regularly. We also spent last year on developing the CRM system. That makes it easier to have an overview of all the information that goes out to our customers at any time.	Relevant to issue 1
S2 - Coordination	Meeting activity	We do not have it on a daily basis, not the sales department at least, we have it once a week. The way the market situation is now, there are too few projects for us to discuss them every week. But yes, we do have regular meetings. And of course, if we are in the end of a project phase, we have daily meetings. Then we sit in teams and work through numbers and discuss ideas all the time.	
S4 - Intelligence	Information flow between S1 and S4	We have a close dialogue with IN because of their special price model. We see that it can both hit and miss completely in different projects, and therefore we have a close dialogue, especially our Bid-manager has a close dialogue because they are trying to calibrate the tool. Based on the cost elements we see that they might not have included.	Talks about the pricing model
S5 - Policy	The boards participation in the operations	They are very hands-on, because most of the board is made up by owners and employee-representatives from the company. Two of the family owners are very active in the Group. And of course, some of the other siblings are not that involved on a detailed level, but they are still very involved. So in that sense we are very much a family ran company	

Figure 3.1: An excerpt of our coding of interviews

Throughout the process of coding the material in Excel, the interview results were fitted into the suggested systems model on a large sheet of paper. This can be found in Appendix III - empiricism visualisation. Our experience is that this had a clear analytical purpose, as we could map the information that circulated in the company, and which tools they had to manage this information. Based on visualising the information flow and categorising which activities that could be viewed as S2-coordination functions, we started generating ideas on what we argued to be unbalanced variety. This was for example the lacking transmission of information between the early phase and the execution phase in projects. We saw that there existed an information platform that was not properly utilised to manage this complex information flow. Based on the generated ideas, the interview guide was partly adjusted before the last interviews to get a deeper understanding of the variety unbalance.

3.5 Quality assessment

In this section, it is specified how we want to deal with the quality assessment of our research. How well an empirical research performs can be assessed by considering four criteria: construct validity, internal validity, external validity, and reliability (Yin, 2017). Common tactics to achieve validity within each criteria are presented in the following table:

Test	Description	Case study tactic	Phase of research
Construct Validity	Establishing correct operational measures	- Use of multiple sources of evidence - Establish chain of evidence	Data collection
Internal Validity	Establishing causal relationships as distinguished from spurious relationships	- Do cognitive mapping - Do explanation building	Data analysis
External Validity	Establishing the domain to which findings can be generalised	- Use theory in single-case studies and field studies	Research design
Reliability	Demonstrate that the operations of a study can be repeated with the same results	- Use case study protocol - Develop case study database - Writing up field notes (observations/interpretations)	Data collection

Table 3.4: Common tactics to achieve validity in empirical research (adapted by Yin (2017))

These tactics will be addressed in the following sections, arguing to what extent each tactic where used.

3.5.1 Construct validity

Construct validity is concerned with the validity of the measures used to collect data. This is known to be especially challenging in case study research, where the researchers might fail to develop a sufficiently operational set of measures and that ”biased” judgements are used to collect the data (Yin, 2017). One common tactic to strengthen the construct validity that was used in our study, was to have key informants review the case study. As company representatives had the chance to give feedback on the proposed viable model of the Group before the first interviews were conducted, our subjective judgements were controlled. Another tactic to strengthen the construct validity is the use of multiple sources of evidence and to establish a chain of evidence. A way of triangulating the study, by using multiple sources of evidence, was to additionally interview a supplier and a customer, and also discuss with professors that were familiar with the company.

3.5.2 Internal validity

Internal validity is mainly a concern of causality (Bryman, 2016). The issue is especially related to explanatory studies, where an investigator is trying to explain how and why ”event x” led to ”event y”. In this study, one of the goals of the interviews was to capture patterns of a viable organisation structure and variety unbalance. To strengthen the internal validity when drawing conclusions based on the data collected, *pattern matching* was used. This is a tactic suggested by Yin (2017), where the empirically based pattern is compared against a predicted one. In the initial video call meetings with company representatives we asked for feedback on the suggested VSM model. In the predicted model, departments of the different subsidiaries were assigned to the different functions of a viable organisation. Based on their feedback we could revise our understanding of how the company was organised, and thereby improve the internal validity. In addition to this,

the findings from the analysis were discussed with company representatives, also known as ”member-checking”. This inclusion of stakeholders is done to identify possible improvement opportunities that the VSM has uncovered (Hildbrand and Bodhanya, 2015). Using the feedback from this meeting, the discussion of the findings where enhanced, as an even deeper understanding of the issue areas was reached. Additionally, two company representatives reviewed and commented on the entire thesis, which strengthens the internal validity even more. We believe that this to a certain extent can weigh up for that we were not able to visit the company due to Covid-19. They have confirmed many of our statements, but also given us feedback on issues we might have misunderstood, so that the data in this thesis is as correct as possible. One of the representatives has an educational background within systems theory, which adds even more value to the feedback on our work and strengthens the validity of how the framework is applied. The trustworthiness of the study is also increased, as a lot of our assumptions were tested with Robert L Flood, an expert within the field of VSM.

3.5.3 External validity

External validity represents the extent to which the findings can be generalised beyond a specific setting to other contexts. In this research, generalisation of the findings concerns their applicability to other other shipyards, as well as other complex ETO-industries, such as i.e. the construction industry. Generalisation can according to Karlsson (2010) sometimes be achieved through comparison with similar cases and with related theory (analytical generalisation). As the chosen research method in this thesis is single case study, it can be argued that the external validity is weakened as compared to a multiple case study. However, since the case study builds on systems theory from the VSM literature, it can be argued that the research can be generalised to other project-oriented companies within the ETO setting, as it is somewhat adaptable. This strengthens the external validity, and is one of the pursued tactics suggested by Yin (2017) to ensure quality of the study.

3.5.4 Reliability

Reliability defines the possibility of other researchers achieving the same results if they follow the same procedures as described by another researcher and conduct the same study over again (Yin, 2017). The main goal is to minimise errors and biases during the study, and a general way of approaching the reliability problem is to make as many procedures as explicit as possible. As shown in Figure 3.4, two tactics are highly desirable to ensure reliability: having a case study protocol to deal with the documentation problem in detail, and the development of a case study database. A proper case study protocol includes both an overview of the case study, data collection procedures, protocol questions that the researcher must keep in mind and a tentative outline for the case study report (Yin, 2017).

The most important raw data was extracted into the report to underpin our findings, but all the data collected (mainly transcribed interviews and handwritten feedback from company representatives) is stored in a database. In this way, reliability is strengthened as interested readers can take a step further and inspect the database, which contains the full array of collected data (Yin, 2017). Another aspect that increases the reliability of the study, is the

fact that VSM in itself has quite an explicit process of how to analyse a company.

Herod (1993) points out that when researchers use interviews as a method to collect data, they must be aware of how the social relations between the informant and the researcher can affect the information obtained. He also states we can not ignore how genders can shape the interaction in the interview situation. As we are two female researchers, it is important to be aware of the biases that can exist, and that this can influence the reliability of our study. All the interviewees in this study were men, and the Group has a male dominated work-place. During the interviews we had this in the back of our mind, and we tried to identify if any statements that were said could be affected by the social relation. We did not notice any bias or gender barriers during our interviews. On the contrary, we were welcomed by everyone that we talked to. The Group also has a female leader, which we believe underlines the gender equality that they strive to have in the group. Therefore, we do not believe that the reliability of this study is reduced by the social relations.

3.6 Limitations of the study

Norway has, as most other countries, been heavily affected by Covid-19 in the spring of 2020. This thesis has been written during this period, which has lead to challenges we could not have foreseen. All planned meetings and travel that was not strictly necessary had to be cancelled during this time. This meant that we were not able to visit the case company at any point during the thesis. All our interviews were delayed by three to four weeks, and it was challenging to interview all the employees we wanted to. The observation at the yard that we had planned for was no longer possible to conduct. However, through our studies we have acquired a lot of knowledge about shipbuilding as well as the terms and jargon that is used in this industry. We where also quite familiar with the company in advance, as they have been participating in our marine engineering subjects at our university. Additionally the work of Mello et al. (2017) provided an appropriate basis for our understanding of the processes at the yards. We do therefor not believe that this has weakened our study noticeably.

Chapter 4

Case Study - System Identification

In this chapter, we have completed all the four steps included in the system identification which can be found in Table 3.1.

4.1 Description of the case object

The focal company in this thesis, denoted as the Group, is a family owned company founded in the beginning of the 1900's. The company consists of several marine enterprises within design and solutions, shipbuilding, shipping and global sales. With its headquarters on the West-Coast of Norway, the Group has for over 100 years been associated with quality and innovation in design and delivery. The company is represented in five different countries, and is divided into three main subsidiaries. The design operation of the Group, further denoted as the Design Department, is responsible for developing concept designs, engineering and delivering equipment packages. The yard operation of the Group, from here on called the Yard is involved in the construction of vessels (shipbuilding). Lastly they have a power and control operation of the group providing electronic, instrumentation and communication equipment. The group also has a subsidiary that is responsible for developing, supporting and facilitating international growth, denoted as the R&D Department in this thesis. To support all these functions, the subsidiary Shared Services holds staff functions like finance, HR, communication, HSE and legal. They also consist of a Strategic Purchasing Unit, which is important for the procurement function in the Group. Some smaller subsidiaries located at the West-Coast are a shipping subsidiary, a subsidiary delivering automation and control systems, and an investment subsidiary. Figure 4.1 outlines how the group is structured. Several companies in both Norway and abroad are located within each of the subsidiaries in the bottom of the figure, but are not outlined.

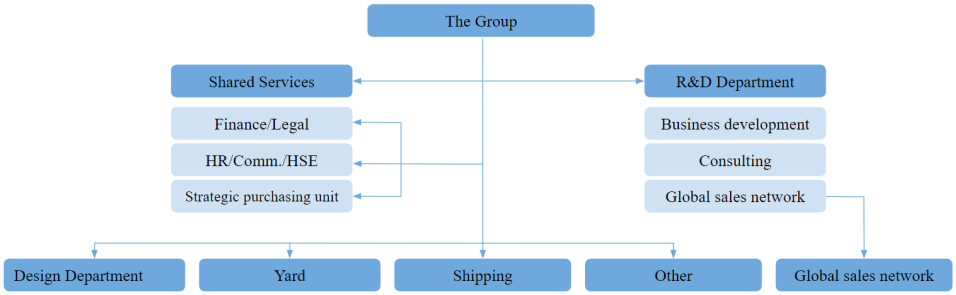

Figure 4.1: The organisational structure of the Group

Throughout the years, the Group has been an important player in the offshore niche market, building a variety of high-end offshore vessels. Over time, the company has been recognised as one of the most modern shipyards in Norway. Historically, they have managed to stay financially robust despite the fluctuating market in the maritime sector. To remain competitive and financially robust after the oil price crisis in 2014, the company used their willingness and ability to change from early on and established themselves quickly in new market segments such as offshore wind vessels, exploration cruise and ferries (Menon, 2019a).

As mentioned in the introduction, it is recognised that it takes time to streamline the new supply chains that have been established. For the Group, none of the customers in the current order book were known to them before 2014. Additionally, many new suppliers are needed for completing vessels in the new market segments. The group faces completely new learning curves, and experience is needed to increase the productivity and profitability.

The project of the interviewed supplier and customer - the Cruise Vessel
The Group delivers multiple projects every year. Some of these projects only involve the Design Department, while others are built by the Yard together with another design company. Therefore it was challenging to limit our scope to only one project when interviewing the employees of the Group, as it would not capture the whole organisational structure of the Group. Even though we did not focus specifically on one project in our interview with the employees, we got the opportunity to interview a customer of a specific project: a Cruise Vessel, ordered by Shipowner A. We interviewed an employee of Shipowner A about their experience of the project. In addition to this, we managed to come in contact with a key supplier of main equipment for this project - the thruster and manoeuvring supplier. We asked them project specific questions as well as more general questions. We aim at analysing the Group independently of this project, but at the same time we believe that looking at a specific project in some contexts can provide even more insight into the Group's organisation and their influence on the environment. The ripple effect of this project was immense. According to the Group 's annual report of 2018, more than 150 suppliers were contracted for this delivery. Approximately 70% of these suppliers were from the Norwegian cluster. And in their report, the Group also assumed that each job created in the shipping industry for a project like this would create five other work places.

4.2 Step 1 - Identify the purpose to be pursued

With the aim of identifying possible efficiency improvements for Norwegian yards to become more viable, the principle of variety is applied. Unbalanced variety can be ”engineered” by making the affected operational units of the Group more autonomous, hopefully making the processes more self-coordinated. Additionally, there are different functions that need to be in place for a company to be fully viable. With these principles in mind, the diagnosis of the focal company aims to see to what extent they are followed. This leads us to the purpose to be pursued for our VSM study:

Are the activities of the Group in line with the principles of a viable system?

This purpose will only be used to guide the viable system diagnosis of the Group, and thereby ultimately contribute to answering the overarching problem statement of this thesis. The purpose will therefore serve as a basis for the discussion in Chapter 6, while the conclusion in Chapter 7 will focus on using this discussion to take a step back and answer the overall problem statement.

4.3 Step 2 - Determine the system in focus

The principle of recursion is established at the Group, as both the Group and each business unit have their own management functions. To illustrate this, Figure 4.2 shows that in addition to the Shared Services support with finance/legal, HR/Commercial/HGE and strategic purchasing unit(see Figure 4.1), the Design Department also have their own finance and HR management.

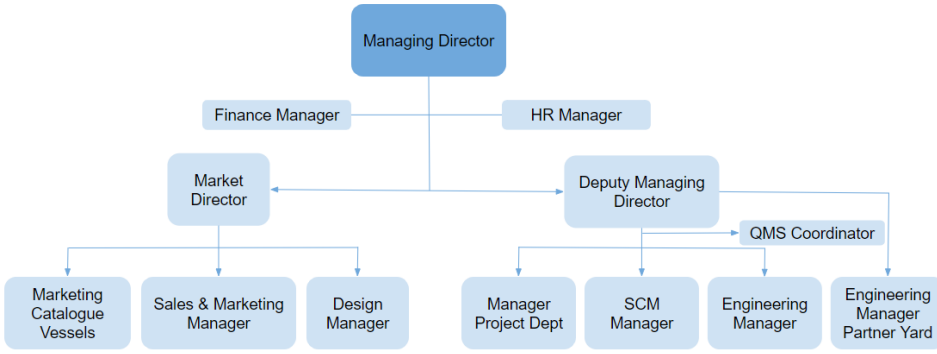

Figure 4.2: Organisational structure of the Design Department

Figures 4.1 and 4.2 represent two different levels of recursion, and show that Beer’s ’Recursive System Theorem’ applies. As suggested by Leonard and Beer (1994), this VSM will only be conducted at one level of recursion, making it possible to compare the functions at different levels. The system in focus for this study is the Group, and the diagnosis will aim at emphasising the communication and information flow within the different

subsidiaries. At one level higher, the Group fits in a wider system of competing yards, equipment suppliers and design companies. At one level lower, you can find all the value creating processes of the different subsidiaries. Figure 4.3 below exemplifies how different levels of recursion are nested in and around the focal company, and outlines what will be our system in focus:

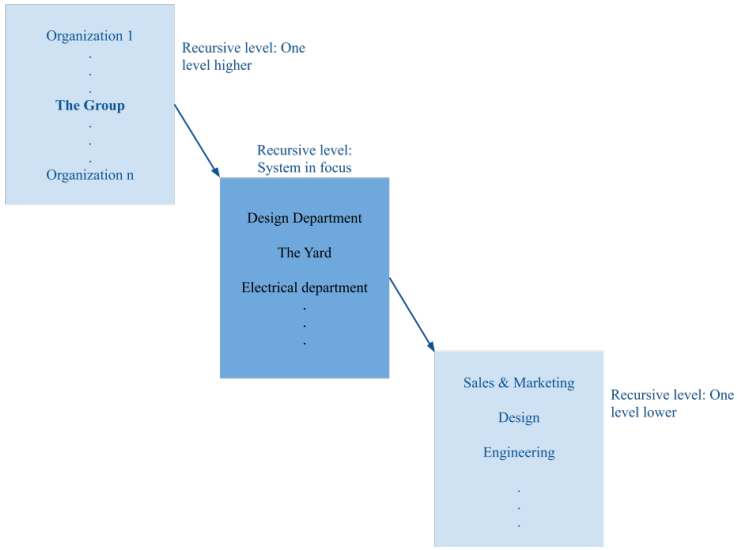

Figure 4.3: System in focus for this VSM

4.3.1 System delimitation

The system in focus contains several subsidiaries, as seen in Fig. 4.1. The VSM will emphasise four of them: the Design Department , the Yard, the R&D Department and the Shared Services. These are argued to be closely connected to the day-to-day activities of the main processes creating value in the Group , and will thus be focal points of our model. However, the other subsidiaries are important actors in the environment surrounding the main activities at the West-Coast of Norway, and contributes to increased variety in the system. Their contributions and collaborations with the defined main subsidiaries is thus noted and implemented in the specified VSM.

4.4 Step 3 - Specify viable parts of System 1

To establish what S1 is made up of, it is necessary to describe the core value-creating activities of a shipbuilding project at the Group. As shipbuilding can not be viewed as a step-wise value creating process, defining the main operations of the Group was challenging. This is where the work of Mello et al. (2017) proved to be very useful. Mello provides an overview over what he defines as the main shipbuilding processes, the actors involved and their separate roles (see Table 4.1). This differentiation is based on a thorough field

study of the Group's designed vessels that were being built both in Norway and at external or third-party yards in other countries.

Shipbuilding processes	**Companies involved**	**Main role**
Tendering: translate shipowner need into product requirements	Shipowner	Externalise aspirations, desires, and expectations, provide information needed and discuss concepts
	Ship designer	Define requirements considering a broad range of aspects(efficiency, safety, cost, etc.) and develop general specifications
Engineering: develop technical specifications based on product requirements	Ship designer	Develop technical specifications and detailed drawings according to schedule
	Main equipment suppliers	Provide technical information about main equipment when it is required
	Shipyard	Provide technical information from other suppliers about equipment when it is required
Procurement: purchase equipment and material based on technical specifications	Ship designer	Negotiate contractual terms and conditions, purchase main equipment and follow up delivery
	Main equipment suppliers	Make quotations, provide technical specifications, and answer inquiries
	Shipyard	Negotiate contractual terms and conditions, purchase materials and equipment and follow up delivery
	Other suppliers	Make quotations, provide technical specifications, and answer queries
Production: manufacture and assembly the vessel following the technical specifications	Ship designer	Deliver technical specifications and drawings, and answer inquiries
	Shipyard	Manufacture blocks, build the hull, and assemble the equipment according to schedule
	Main equipment suppliers	Deliver equipment according to the specifications received from engineering
	Other suppliers	Deliver equipment according to the specifications received from shipyard
	Shipowner	Follow up the realisation of quality checks and monitor the progress of the project execution
Commissioning: assure that the vessel is ready to operate and evaluate the adherence to contractual specifications	Main equipment suppliers	Inspection and test equipment, generate reports, and provide technical support
	Shipyard	Perform sea trials, make adjustments, and support suppliers
	Shipowner	Supervise tests, provide feedback, and involve crew members

Table 4.1: Main shipbuilding processes - adapted from Mello et al. (2017)

With our company representatives we discussed the way Mello et al. (2017) defined the main value creating processes of the shipbuilding company. We agreed that his findings could also serve as the basis for our analysis. Due to the Covid-19 situation mentioned in Chapter 3 that postponed many of our interviews, it was agreed with company representatives that adopting the processes of Mello et al. (2017) was a sensible way of solving the situation. However, we did a minor adjustment to the processes. We argue that the Design Department constitutes an important part of the Group's flexibility and competitive edge, as not all yards have their own design department. Therefore it is chosen to also emphasise design together with engineering. Hence, the day-to-day activities creating value in the Group, which constitutes the viable parts of S1, is:

Tendering - marketing and sales, concept design, request for tender, project bid, contract negotiation (the Design Department, the Yard, the R&D Department, Shared Services)

Design and engineering - project planning, detailed design and solutions, engineering (the Design Department, the Yard, the R&D Department)

Procurement - Request equipment from suppliers, negotiate price, purchase components (the Design Department, the Yard, Shared Services)

Production - fabrication, outfitting, painting, furnishing (the Design Department, the Yard)

Commissioning - sea trials to test the vessel (the Yard)

Based on the descriptions of companies involved in Table 4.1, and verification with company representatives, each process is linked to corresponding companies who manage the day-to-day activities. In our case, this is either the Design Department , the Yard, the R&D Department or the Shared Services. These provide local autonomy to the S1 operations, enhancing the viability of the organisation. Mello et al. (2017)'s work and confirmation with company representatives allows us to make an initial model the Group as a viable system:

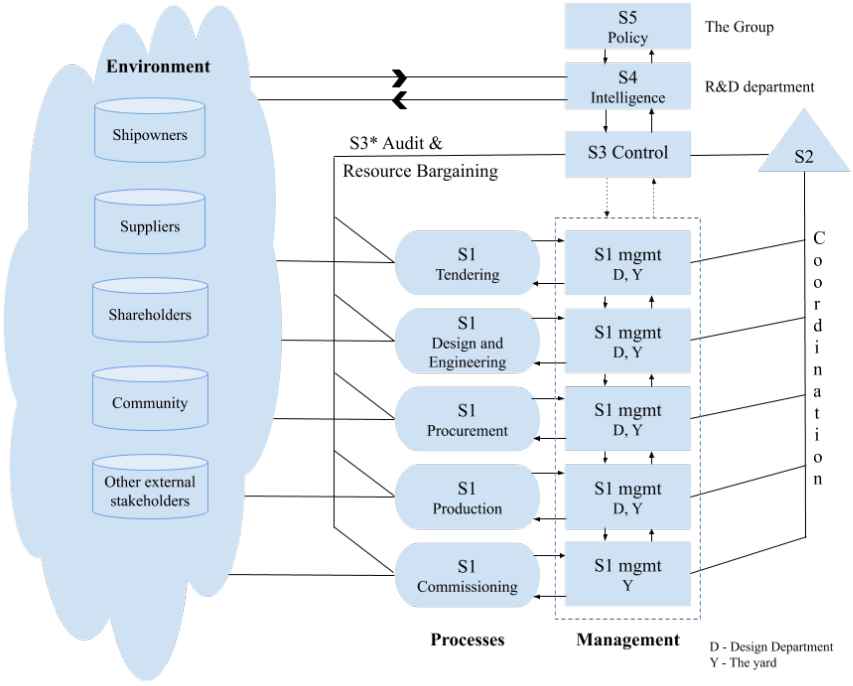

Figure 4.4: Structure of the system in focus - based on empirical data from Mello et al. (2017)

The suggested model provides a great starting point for developing an interview guide, and for visualising and generating ideas when analysing the collected material. However, interviews are still necessary to fully verify the initial perception of how the company is organised, and to ensure that it is reasonable to use the identified processes of Mello et al. (2017).

The fact that the subsidiaries are present at several of the processes simultaneously, reflects the complexity of shipbuilding projects. Vast flows of information and materials is transferred both vertically and horizontally in the VSM, requiring functions capable of controlling the variety in the system. This calls for an analysis of the existing functions in the Group to see if they follow the principles of a viable organisation. Hence, the complete viable system should be specified, leading us to the next step in this diagnosis - analysing empirical data from the focal company.

Chapter 5

Empirical Analysis

5.1 Step 4 - Specifying the viable system: the Group

The organisational structure of the Group is in this chapter detailed through a VSM lens. In the following sections, each of the functions S1-S5 that are necessary for the Group to be viable are extensively explained. The environment that surrounds the Group is also described, as it has a considerable impact on the daily operations of the system. Lastly, the capacity of the communication channels connecting the systems are detailed. Throughout this thesis, all quotations are translated from Norwegian to English.

5.1.1 S1: Operations

Shipbuilding is - as described in the introduction of this thesis - a complex process. The enormous amount of information, engineering disciplines, and the need to consider customer specific requirements makes the coordination and planning of a streamlined building process difficult. Also, the customer specification can often be somewhat vague. In addition to this, design and engineering activities are sometimes performed concurrently with production, which drives up the complexity (Emblemsvåg, 2014). The description of each value-creating process shows the complexity found in shipbuilding projects. They are explained as explicitly as possible so that the reader can grasp what constitutes the day-to-day activities at the shipyard. As aforementioned, the processes that create value in the Group are:

1. Tendering
2. Design and engineering
3. Procurement
4. Production
5. Commissioning

With these activities as a basis, the analysis focuses on mapping the content of the operations, the management of each activity, the information flow between them, and the coordination of the complex and entangled projects.

Tendering

In this thesis, we have included several processes under the tendering activity. It involves everything from the early phase contact with a potential customer, through the process of making an offer, and all the way to signing a contract. Then the project reaches the next value creating operation:

> ”We sign the contract, then it moves on to the people who are going to see the whole project through. We move over to the execution phase”

The process of tendering includes several of the subsidiaries in the Group. Both the Yard and the Design Department have their own sales teams working continuously towards current and potential customers. In addition to this, the R&D Department manages global sales activities as well as consulting, project establishments and business development. In this way, the Group has three channels to the market, which together handle national and international sales activity. The collaboration on sales and tendering between the subsidiaries has been strengthened during the past seven years. An employee from higher management stated that:

> ”The communication that comes in on the three different channels in the early phase of projects has become incredibly much better. It is almost nothing that won't be communicated or somehow exchanged. This was not the case seven years ago. Then, an inquiry to the Yard stayed in the Yard, with few exceptions. Today there are no barriers between the subsidiaries on everything that concerns concepts, all the way down to concept design and business cases. We exchange all the information we want and can convey.”

In addition to the work of the Yard, the Design Department and the R&D Department, important functions from the Shared Services are needed to conduct the tendering process. The Strategic Purchasing Unit plays a key role in tendering, as they can work out pricing on large equipment deliveries accounting for up to 80 % of the total value of equipment on a vessel. Before the establishment of the Strategic Purchasing Unit two years ago, both the Yard and the Design Department had their separate procurement departments. Today, the Strategic Purchasing Unit can support both subsidiaries in everything from early phase price calculation and tendering equipment, to handling the procurement when a contract is signed. A Strategic Purchasing Unit employee explains:

> ”In principle we rent ourselves out to the Design Department and the Yard, and we support everything in early sales, when the salesmen try to calculate what the ship should cost, we help with calculating and collect offers from suppliers. This is something we do across company boarders. And if we get a contract on a ship, we handle the purchasing of the main equipment”

As explained to us during the initial conversations with company representatives, this equipment is mainly what they categorise as A-components: i.e main engines, propulsion systems or furnishing on cruise ships. Hence, they constitute an important part of the tendering process, and play a critical role in the Groups price competitiveness.

Another important function of Shared Services in the tendering process is the work of the financial controllers. By revising the projects, they provide important inputs to the price calculations. The company has relocated the bid manager to the financial department to have a cross link between the Yard and the financial controllers:

> ”The bid manager is organised together with the financial controllers, which to a larger degree secures our monthly feedback on project-reporting, which enables us to update our key figures, and make continuous adjustments”

Based on empiricism, it seems that pricing is a difficult task in today's operations. According to higher management, they need to both understand what drives the prices in the market, but also what constitutes the costs of a newbuild project, which is difficult. A manager states that:

> ”We have performed poorly in pricing our projects precisely”

A representative from the sales department in the Yard has a clear idea on how this should be harmonised:

> ”Evaluation is extremely important. The way we have structured our sales process now needs a lot more feedback from the execution phase”

As we consider evaluation as a coordination mechanism that should the managed by the S2 function, this will be further addressed in Section 5.1.2

While the communication between the subsidiaries is considered to be good in the early phases of projects, it is during the pricing process of the tendering activity that problems start to reveal themselves. On the one hand they have the development of technical solutions, where they cooperate closely. But when they need to start considering the commercial aspect of projects, information starts to become sensitive, and expenses become an issue. One employee told the following:

> ”The collaboration is mostly good, all until we start discussing things that costs money. Then both companies are quite focused on getting their expenses covered by the other party.”

This problem seems to originate from the business model the Group has imposed their subsidiaries, which affects transfer pricing. There has been an ongoing discussion for several years on how the subsidiaries should be financially structured, which is a common issue in umbrella organisations, and the issue will be further discussed from a VSM perspective in Section 5.2.

Design and engineering

As mentioned earlier, one of the strengths of the Group is that they have incorporated their own design company. This provides flexibility for the Group's operations: a design from the Design Department can be built both at the Yard, but also at other third party yards. Similarly, the Yard can build vessels designed by the Design Department, or by other external companies. The Design Department is therefore treated as a basic supplier by the Yard.

A large share of the Group's operations is the Design Department's work with third party yards world-wide. They serve as a provider of both ship design, technical solutions and consultancy work. They support the yards all the way from the contract signature of a newbuild, to the delivering of the finished vessel or series of vessels. These operations fall outside the scope of this thesis, but it adds an aspect to the communication and collaboration between the Design Department and the Yard that are considered in this analysis. As a representative from the R&D Department stated:

> "The Design Department works with other yards, and spreading the information they get from these is a sensitive subject. At the same time, the Yard is building boats with designs from other design companies. Taking this information and spreading it to the Design Department is also sensitive. It is a lot easier when they use the R&D Department as the bridge between. It is not as sensitive when they use us between."

During the engineering and design phase of a project, the ship designer - the Design Department or an external designer - will develop the technical specifications based on the product requirements that were agreed upon during the tendering process. The building process will be planned in this phase as well, involving both the design company, the yard and the main equipment suppliers. The yard and suppliers should provide technical information about equipment and capability when this is required. This is exemplified by a sales manager thought on one of the latest projects that was built on the Yard:

> "The Design Department is very involved, especially in the cruise project we had. We had no experience at all with cruise when we started with that in 2015. Our goal as a complete group was to take the concept from the first idea, to delivering a complete ship. And design is of course a crucial part of this, as visualisation is extremely important. So the Design Department was heavily involved in the first phases, and they were central to finding solutions. The sales department and the Design Department had a very good collaboration in the start. In the next phases, when stability calculations, measurements, inclining experiments, speed tests and such was to be calculated - basically showing how the boat would function - they were also involved, but with different people and on a different level."

Unfortunately we lack more interviews and reactions on this core operation. We were not able to interview all the subjects we had planned due to Covid-19, and we did not get the opportunity to talk to a naval architect in the Group. However, we argue that the collected empiricism is at a satisfactory level, as we have covered the theme found most interesting in this analysis - the collaboration between the departments in the different phases.

Procurement

The procurement process is about purchasing equipment and materials that are based on the technical specifications made in the tendering and design phase. As mentioned, this is handled in two ways in the Group: the Strategic Purchasing Unit handles the procurement of A-components (large critical components), while the Yard has their own procurement department for B- (more standard, but still important) and C-components (standard). The Strategic Purchasing Unit consists of a team of five persons collaborating closely and talking to each other every day. When there is a sales project, a ”lead purchaser” is chosen, who becomes responsible for setting up the necessary systems and challenging the chosen purchase strategy. The responsibility of this unit is to collect necessary documentation, work through documentation, send out requests and get prices in return. Their job ends when the contracts with the suppliers are signed and handed over to either the purchasing unit in the Yard, or project manager or logistics department in the Design Department. The contracts handed over to the different departments seem to be quite complete. As a project manager stated, the problem is not the content of the contracts handed over, but rather following them up in the best possible way:

> ”It is procurement that handles the part related to progress reporting and important strategic deliveries, where you ask for status and progress, which is included in the contracts handed over. We are usually quite secured through the contracts. The challenge is rather to follow them closely. It is the project management team’s responsibility to exploit them properly.”

The people involved in procurement are, as mentioned in the section about Tendering, essential to get precise pricing. However, empiricism shows that poor communication between the Yard and the Strategic Purchasing Unit may reduce the potential that lies in having a separate purchasing unit. This might be an oscillating factor in the procurement operation. A Strategic Purchasing Unit-purchaser mentions the following:

> ”In some projects are we included throughout the process, while in other projects they just do their own thing, and do not share anything. Then it is hard to help them. It is not much that needs to be informed on. Minor resources and energy is necessary to ’keep us warm’ so that we can help. I think we can get better at this. The communication can become better in terms of including people along the way. I think we have a potential there”

His statement also underlines that the quality and quantity of communication varies from project to project, pointing towards lack of standard procedures and strategic understanding in the procurement of A-components. This is also supported by an employee from higher management:

> ”Perhaps they [people from procurement involved in price calculation] have an insufficient understanding of the overall strategy of a project. They may negotiate without having a strategic understanding of how important the different components are? More communication and training is needed to understand what we should spend time on. We are not good enough with this.”

This frustration might be connected to how the Group distinguishes A, B and C components, which is highly related to their strategic view on purchasing. While A-components should be prioritised, B- and C-components are often less focused on in a strategic way. The following statement from the higher management employee supports this impression:

> ”We handle most purchases in quite similar ways. But the value of them can vary from hundreds of millions to only a million or maybe half a million. We should obviously keep track of the differences here”

The B- and C- components that the employee might be referring to are handled by the Yard purchasers. The Yard has one supply chain manager who is in charge of four to five purchasers. He explains what his main areas of responsibility are:

> ”I am responsible for the project purchasers. They purchase project specific equipment. I am also responsible for the warehouse, the logistics in and out, with marking, storing, sending and receiving to our hull yard abroad. All the shipments in to our warehouse are usually handled by our suppliers”

Based on his statement he is not involved in much of the A-component purchasing. His purchasing team seem to be responsible for acquiring B-components - critical items, but not necessarily tailor made for the project. As understood from the earlier statements, these can still be costly, and therefore they should have a strategic view on these items as well. C-components usually comprise of the smaller parts of a ship that are necessary, but neither difficult or costly to acquire, like nuts and bolts. It is common to let your suppliers take care of continuously restocking these small items, like the Yard does. It seems that the supply chain manager has quite clear areas of responsibility. He goes on to tell who he cooperates the most with during his working day:

> ”Mainly the other people in the management group. Our project managers, the project purchasers who report to me, and also the Strategic Purchasing Unit, who handle strategic purchases for us. I have a very close dialogue with them”

This is interesting, as neither the project managers nor the Strategic Purchasing Unit representative confirm this in their interview when asked who they communicate the most with during their day. From the Strategic Purchasing Unit employee on who he says he talks to:

> ”The sales managers in the Design Department and the Yard [...] I talk a lot to the bid manager, and technical manager in the Yard [...] Also the technical coordinators in the Design Department and the Yard. Finance controllers and finance managers. I talk a lot with the CEO of the Yard.”

Neither the project manager mentions the supply chain manager when he is asked the same question:

> ”Most definitely the members of my project group - the leaders of the discipline groups”

These statements might indicate that the purchasing of B- and C-components is not viewed as being very important for the Strategic Purchasing Unit employee and project manager. This strengthens the suspicion of that B- and C- components are not purchased with a specific strategic view. The splitting of tasks and communication also seems to affect the suppliers in their process of selling parts to the Group. In an interview with one of the Group's suppliers of A-components to the Cruise Vessel the following was said:

> "This [the purchasing of A-components] is a difficult internal process for the yards. We are good friends with the guys in the sales department, they often want to have us on board. And then the purchasers are obliged to cut costs. We often get a signal from them about which direction things are headed. We help them with technical solutions even though they haven't ordered anything from us yet. And then the purchasers enter the playing field again, and try to make themselves important. We have had good discussions with the technical departments, so we feel pretty safe on this going through. But then they start pressuring us on price, which is understandable as it is their mandate. But here the chemistry is extremely important. Some of the purchasers appeal to common sense, while others behave in a authoritative way, almost dictatorial, and they sort of threaten you on price. We just want everything to run smoothly and land on a good solution."

As a response to this feedback, a company representative explained the challenge behind this process:

> "The challenge is that we let the technical department and the suppliers 'dream together' about technical solutions, but when it comes to the actual pricing the vessel, we are out of the game. The technical department must keep price and commercial perspective in mind all the time, so we do not face this price issue at the end of the process."

The trade-off in pricing is even more important now, as up to 80% of the value added is externally produced. It can be questioned whether the organisation of procurement in the Group can be streamlined in a way that improves efficiency and effectiveness of this operation. Applying a holistic view on the interconnected processes between tendering, procurement, engineering and production can provide insight into what might act as hindrances for efficient procurement.

Production

The production of ships at the Group has changed in line with the development of the industry. Production entails manufacturing and assembling the vessel according to the technical specifications, within budget, and by the agreed upon date. This phase of the project involves the ship designer, the shipyard, suppliers and the ship owner. In the Group's earliest years they would build the whole ship at their local yard, but globalisation and technology has changed this. Now, the Group mainly outsources the construction of the hull to third party yards in low cost countries like Poland, Croatia and Ukraine to achieve competitive prices on material and labour. This has changed the production routines in the Yard, which the project manager explains further:

> ”In the early phase of the project we follow up the hull, and make sure they get the necessary support. Because we build our hulls in the Low Cost Country at the moment. When the hull is close to completion, planning and detailed planning becomes more and more important. We also need to rig our project group for execution in our own yard when the hull comes over here. That is when we enter the production and outfitting phase.”

The customer of the Cruise Vessel project adds more detail to the specifics of the process:

> ”All of the steel work is done in the Low Cost Country. All the heavy components like main engines, winches, mooring winches - all of it is put on board, but the welding is not done before they arrive at the Yard. Also, not a lot of the painting gets done in the Low Cost Country either. Almost all the painting work on internal tanks [i.e. water ballast tanks, fuel tanks] was done at the Yard. It was almost only steel in the Low Cost Country. And a large amount of piping of course.”

The ship then makes the journey from Country B to the West-Coast of Norway where it will be completed. The production and outfitting phase at the Yard involves a number of disciplines. The project manager mentions the following as being key:

> ”We have discipline managers who are responsible for separate areas. One is responsible for electrical technical, another for electrical production, yet another on electrical furnishing. Then we also have one on furnishing technical and the same on production.”

The customer of the cruise vessel adds to this by explaining what happened on the project:

> ”All the cabling was done at the Yard. They [the interior supplier] build the cabins [for the cruise ferry] on-site, which surprised me a lot. At other yards they often deliver sections that are complete. Then they cut out a hole on the side of the boat, and shove the sections in. Instead of this, the Group does it the traditional way.”

It is known that the outfitting of the ship requires highly skilled workers, especially on the high technology ships that the Group are known to build. Their name is seen as a quality stamp both in Norway and internationally.

Commissioning

In the commissioning phase, the functionality of the vessel is tested to confirm that everything is in adherence to the contractual specifications of the customer. In this phase the customer is highly involved. The Cruise Vessel owner representative explains:

> ”I was very involved in the commissioning phase. Mostly on the bridge. We had a technology supplier as outfitter of the bridge [the control centre], so during the winter we tested the vessel with them. The ship also sailed in the fjords of the West-Coast. From the owners side I was the one who was responsible for testing the bridge.

The customer also describes who were involved from the Group during the commissioning:

> ”We had a discipline manager on electrical. He was our contact towards the technology supplier. Also, the new director of the Yard was there on the sea trial. A lot of what happens during the commissioning is very technical, which I am not very involved in. The engine manager and the electrician manager were important. And the site manager - he had an education within engines. So the main engines are important during the commissioning. The sea trial is kind of a commissioning test on everything though, how the main equipment and the ship functions. There are a lot of class requirements and governmental requirements as to how the ship should react when you do certain tests, so there are a lot of things we need to go through. Many class requirements from the classing company need to be met. Also, requirements from the Norwegian Maritime Directorate - everything related to safety, like lifesaving equipment and firefighting equipment.”

It becomes clear that an important part of the commissioning phase is testing, and that it involves several stakeholders. This is reflected in intensification of the meeting activity at the Yard when the project enters this phase. A project manager states the following:

> ”The last 8-10 weeks, depending on the project, we have our starting and testing phase. Then we have daily morning meetings where we discuss progress and supervision of the project. We complete the commissioning phase with a final sea trial.”

The shipyards are usually pressed on time during this stage of the project, which increases the intensity of this phase even more.

5.1.2 S2: Coordination

As explained in Chapter 2.1, one of the challenges related to shipbuilding as a project process, is that several of the operations are being carried out concurrently. They are dependent on each other, but they are still separable operations that should be viable by themselves. This calls for effective, reliable and responsive coordination between them. The main coordination tools we have identified through our analysis are meetings, IT-systems and evaluation, and planning.

Meetings

The Group has three main types of meetings: scheduled meetings, project meetings and ad-hoc meetings. The scheduled meetings run independently of activities in the Yard, while project meetings vary based on which stage of the project the Yard is in. Our interviews have revealed that there are frequent ad-hoc meetings between many of the employees in the Group as well. In the following paragraphs attempt to outline the most important meetings that affect the coordination of the organisation.

Project meetings:
These meetings are held on a weekly basis whenever the Yard has an ongoing project. They are meant to coordinate all the workers that take part in the project. The meeting participants vary based on which phase of the process the project is in. The meetings also have sub-meetings within the different departments. Examples of these are sales-project meetings, purchasing-project meetings and technical-project meetings. These sub-meetings aim at contributing to the projects as well, and are not a part of the regular meetings the different departments have. The project manager and his team create a period plan, which will be further explained later in this chapter. It has a horizon of approximately 8 weeks, and the weekly plans are based on this.

In the early phases the project meetings are concerned with technical and purchasing related issues. Following up the hull production at third-party yards is also important in the early stages. Planning for the arrival of the hull is of paramount importance, since the Yard and the team needs to be prepared and fully equipped to handle the handover. As the project progresses, the meetings focus more and more on production and outfitting matters. This is when the focus of the project changes. A project manager states the following:

> ”When going over to the production and outfitting phase, the focus changes, as you actually have to implement everything you have been planning ahead, your ideas, drawings and thoughts. The last 8 to 10 weeks you are usually in a commissioning phase, where you have daily morning meetings.”

In these meetings they discuss progress and supervision, and work towards the milestone of the first sea trial of the ship. After this has been completed, these meetings go on for two weeks or so, where they finish all the necessary paperwork.

Management meetings:
The management meetings take place approximately once every month, where all the managers come together. This meeting has an administrative focus.

Department meetings:
These meetings are usually held every other week, and last for around 45 minutes. The meetings vary a bit from department to department.

The sales department uses these meetings to discuss projects. Depending on where they are with the different projects, the themes for the meetings can be whether they have enough documentation, if something can be misunderstood, and what the consequences of their actions are. They also discuss what their status is on new leads and how they should prioritise. A sales employee shares more:

> ”Generally in a sales meeting, we normally talk about all the projects we have registered, to find out what the status is on them. We also discuss how they should be prioritised. The agenda is pretty simple actually.”

The purchasing department have status meetings to get an overview of what each employee is working on. They share their thoughts and communicate information that is important

to share, but that should not necessarily be available in writing. They also discuss improvement measures, status on current projects and new projects:

> ”We all discuss what we are doing, it is a good arena to discuss things and communicate information. Generally we also talk about our ongoing projects, and coming projects.”

Shipowner meetings:
Shipowner meetings are one of the few meetings with someone from the environment that takes place regularly throughout a project. These meetings usually have a monthly frequency, depending on the phase of the project. Towards the end of the project, this frequency might increase when necessary. Even though this is the only regular meeting that is dedicated to discussions with the customer, the customer can still be involved in much more. From the Shipowner A representative:

> ”I attended many meetings during the project. I was involved in most meetings except detailed meetings on electrical for example. But I joined in on all the important meetings together with the project manager and site manager. And their project managers. The government and classing companies also took part in several meetings”

Kickoff meetings:
The kickoff meeting that takes place after a tender is won and before the project is transferred to the other operations seems to be crucial for the overall success of the project. The interview objects call it a meeting, but it runs over one to three weeks, and massive amounts of information is transferred during this process. This transition is tricky because there is a complete replacement of the team that works on the project. The ”meeting” includes many other meetings between different functions in the organisation. The Group has tried different ways to succeed with this. A sales manager explains:

> ”We have tried to include the project manager in the sales phase as early as possible when he has been available for this. In that way, the project manager has the background information on what has been discussed with the client. But this is not always possible. Sometimes we try it the other way around, so the sales manager has taken over the role as project manager in the first part of the project to ensure good information transfer.”

He also points out the importance of this meeting, and describes how almost the whole organisation takes part in it:

> ”This might be the biggest challenge we have as a yard, and I believe this is generally true for all yards. The transition from sales to execution. The most important meeting we have is in the phase where we have a kickoff and information transfer. This starts right before signing. Many of the technical line managers are present, the production manager is present, and the project manager is taking part in all of the decisions that are being made. A lot of the people in the organisation gets information in the phase before we sign the contract.”

This is confirmed by the Supplier:

> ”This is a very difficult internal process for the Yard. We also notice it, because we go from discussing things with the sales department, to talking to the procurement and project departments.

The kickoff meeting facilitates several other meetings during the time that it goes on, and it can be discussed if it is correct to call it a kickoff *meeting* in that sense:

> ”We have a separate meeting with the financial controllers for example, so that they get insight into the reviews that have been done on the calculations. We have another meeting with technical, to provide insight into the most important discussions that have been going on. We spend a lot of time on this, but probably not enough. There are always discussions throughout the project. But it gives them a good start, a good understanding of the process we have had with the client in advance.”

It is clear that this kickoff meeting is challenging, but very important for the success of the project. It is notable that it varies if the project manager is available to be included in the sales phase. This might indicate oscillations in the system when no routine is followed, and will be further discussed later. In line with this, a project manager states:

> ”Early in the process, when I don’t have a large project team, it can be challenging for me to take over. Especially when I have not had the time to be included in the sales phase, and I have to learn everything later.

IT systems and evaluation

Another important coordination tool to ensure distribution of information is the IT-systems. Based on our interviews, we have identified several IT-systems that support coordination, for example Sharepoint and the new Microsoft Dynamics-systems they have implemented. Especially the Dynamics-system CRM (Customer Relations Management) caught our attention as it seems to have large potential for coordination purposes. In an effort to streamline the Groups reports, Power BI is used as a reporting tool. This is meant to reduce problems related to change in workers. Much of the daily reporting is still done manually in Excel sheets. They are trying to automate this in Power BI, to gain better visualisation of for example costs in projects. It is important for coordination as all the operations have to be up to date on the cost picture. In addition to this, there are several IT-systems that will be emphasised in the analysis of the communication channels in Section 5.1.7.

The different IT-systems contain an abounding amount of information that can be utilised to address what several interview objects suggested should be improved: continuous evaluation of projects.

> ”In the sales department it is crucial that we complete the evaluation, not just when the project is finished, but also long the way. We work on new projects all the time, so we have to collect data and relevant feedback from projects

that are ongoing so that we can use that for our next calculations. Otherwise we will only get the same errors over and over again. We want a more formal evaluation for each important step in the project."

Planning

The Group uses periodic plans to coordinate between the different operations of the organisation. The period plan is, as previously mentioned, an important tool to schedule for the activities ahead. This plan is "owned" by the project group in every specific project. It coordinates the work related to both the technical department and the production operations. Based on this, a week plan is developed. This is on a lower level, and includes the specific work of the foremen.
A project manager mentions the importance of planning, and the challenges related to it:

> "To plan early in the project is probably one of the most important things we can do to prepare. But there is a problem related to the human nature - it is difficult to plan very far ahead. If you come in to a meeting and start talking about what will happen in two months and no one is prepared, it is difficult to get anything done"

This is supported by higher management:

> "We see that we have to spend much more time upstream in the projects, and plan more on beforehand. We do not have a lot of experience with this, and we do not have a lot of people doing it."

This is also related to the difficulties in planning:

> "It is all related to time. We have to spend our time right. Because it is very challenging to plan, not just in my department, but in the whole project. If you do not have enough time, the result will not be that good."

It does seem like this is an issue the Group is addressing. A sales manager tells us about learning's from a previous project:

> "We see that we could have done things differently, and we have learnt a lot. Now we have people that know this, and we can streamline the processes before the next ship. I believe that if we use this opportunity to plan better, like we are doing now, that will help"

These quotes show the importance of planning, and especially early planning in shipbuilding. At the same time, they portrait the challenges related to planning so far ahead, as being due to human nature, and to time constraints.

5.1.3 S3: Control

The control system is meant to handle the issues that are too large for S2 to deal with. It should make sure that the policy created by higher management is implemented in the organisation. The most important audit and control procedures found based on our interviews include: budget reviews, project process reviews and performance indicators.

Budget

The control system is responsible for setting budgets. The budget reviewing varies a bit from department to department. In general the projects have monthly budget reviews. An employee from the Yard explains how the budget reviews are conducted in his department:

> ”The Yard does budget reviews when reporting to the Group, which happens 10-12 times per year. We report on all our projects. I believe this is done in the same way at the Design Department.”

This is elaborated on by another employee in a higher position, who explains the budget reviews done on projects in further detail. He also mentions another important control function - project process - which will be described later:

> ”There are two procedures that the Yard has when doing a project. One of them is done every other week - project progress - how many hours we have spent, how far we are from the finish line. Also, every three months we have a budget review. We start of with one budget, and then we adjust it every three months.”

This makes it clear that the Group has specific routines when it comes to reviewing budgets both in departments and on projects. When asking about the availability of the budget status of the departments, we discovered that the Group has taken measures the last years to make this more transparent and easy to access, as explained by an employee in a management position:

> ”It has become much easier now, through the new system. We can check the budget status every day if we want to. Before it was more on a overall level, and only a few times a year. But now it is being followed up every month.”

The overall impression is that the workers like the transparency of the budget review as a control function. It is perceived as a supporting function rather than a controlling one:

> ”Now I have full control on how much I can spend on different things like travel and exhibitions, and I can see it all on Power BI, on a weekly basis.”

The overall budget for the corporation also seems to be transparent:

> ”When it comes to the overall budget in relation to turnover in the group and so on, we do not review this as often. But it is in a way very transparent in the whole organisation. Those who need to know they know.”

Overall the Group’s budget reviews seem to be satisfactory. They are done regularly, and the employees see them as transparent and helpful.

Challenges related to control of physical project progress

As mentioned earlier, the Group has lost millions in profit due to issues with pricing. A part of this loss seems to stem from a lack of control of the physical progress of projects. The yard has functions in place to measure project process, but they struggle with measuring this in the right units. Measuring in terms of monetary value or in terms of working hours is easier, but does not paint a complete picture of the progress at the Yard. An interview object explains:

> ”In regards to financial consumption we have had a close and satisfactory follow-up of our projects. The main problem is that we actually do not have good measurements of physical progress on our projects. We simply cannot measure when things are done - this is something we want to work on, developing a better system for measuring physical progress. We have had too much focus on economics, and too little on physical connections.”

It becomes clear that several of the employees we have interviewed see this as an issue. It is believed that this has played a major role in the pricing issues. This is acute, and has to be dealt with if the Group is aiming at improving their pricing capabilities.

Performance standards

Based on the data from the interviews we have conducted so far, there are no common performance indicators for the employees in the group. We have specifically asked which performance indicators they use to measure goal achievement, and we got the following answers, the first being from the purchasing department:

> ”The percentage that we manage to push the price down”

The second one from the sales department:

> ”The amount of contracts we sign per year”

And this one from the Strategic Purchasing Unit:

> ”A total reduction of X percent of the total price”

The indicators of performance do not seem to be clearly defined, but the overarching goals of their work appears to clear to the employees. This is not considered to be a large fault in the system, and we will therefore not explore this further.

5.1.4 S4: Intelligence

According to literature, the S4-function is a two-way link between the viable system and its external environment. It provides continuous feedback on marketplace conditions, technology changes and all external factors relevant to it in the future. In addition should it project the system’s identity and message to the environment (Espejo and Gill, 1997). All these activities relate to the work done by the R&D Department. A higher manager in the R&D Department details their activities:

> ”Much of the marketing is done from here. Because of our innovation-abilities, we have contact with many potential customers, and customers in the early phase. We also consider expansions and development of our products based on the market. We have a close cooperation with five to ten key universities around the world, and follow up some PhD students - that is our way to stay fresh. We also do many business case projects, where we try to strategise by screening and scanning the market.

Through the R&D Department, the Group has clearly covered much of the need a viable system has to connect to the environment, understand the information that flows around there, and use this information to internal adjustments.

The team in the R&D Department consists of only five persons, working continuously with projects related to internal development of the Group's businesses, and its related business areas. This can be such as looking into expansion of their service portfolio. In addition to this, the R&D Department has a corporate responsibility in strategic research, which consists of initiating and following up internal and collaboration R&D projects both nationally and internationally. The R&D Department is also responsible for maintaining a good relation to the Universities to be close to the places where new knowledge is developing.

The subsidiaries also use the R&D Department on a daily basis for project-based inquiries to perform market analysis, vessel business case evaluation, pricing calibration and other technical data-based analyses.

The R&D Department works closely with the board of management, and many of the business cases are discussed with top management before it is transferred to the boards of the different subsidiaries. In this way, the Group always exercise fact-based decision making.

> ”Every decision in this company is fact-based, and based on an analysis”

As interviews with the sales department in the Yard showed that they have a close connection to the external environment, and seems to possess a lot of information on what is happening in the market, it was of interest to see if this information got transferred upwards in the organisation and to the ”operations room” the R&D Department represents. When we asked to what extent the R&D Department gets this information, a representative answered:

> ”To a small extent. There is no reason that this information is not immediately available. Of course, there are some practical problems here. We do not have resources to fly around and talk to each other, and we are also located physically in separate buildings”.

This makes us question whether a common platform could be a place where information would be able to flow more easily upwards in the organisation. Such a system could be the Customer Relation Management (CRM) system mentioned by sales people in the Yard. As

the R&D Department recognises, a lot of the early phase communication with customers is oral, but everything goes into the CRM. Their reply when we asked about their insight into the CRM was:

> ”We do not use it that often. Maybe we could. But we are probably a lot better at just communicating with each other, as we want to be an open box”

It seems to be true that the whole group has become more transparent the last few years. As they have become important for the development of the subsidiaries, the R&D Department has access to the accounting and the communication systems within them. They can therefore collect data without asking, which is a different situation from just a few years ago.

5.1.5 S5: Policy

S5 is in place to deal with the issues of management style, as well as strategic decisions. This function should set vision, mission, a direction, and objectives to be met. The board of the Group seem to constitute the S5 function in this system, and is highly influenced by the fact that the Group is a family owned business. On the Group's website their vision, mission and objectives are clearly stated. Their slogan is ”Turning visions in to reality” and their vision is ”We create tomorrow's solutions for sustainable marine operations”. They also set a direction towards reaching their goals with the following strategy: ”Our strategy is to achieve sustainable growth and to promote our international position through dedicated innovation processes and respect for diversity.” These statements are of course also created to appeal to the customers of the Group. We have tried to understand if the meaning of them aligns with the perception of the workers by asking what the overarching goal of their department is. This will indicate how the ”ethos” set by S5 is perceived by S1. Most of the answers we got support both mission, vision and direction found on the website. Several of the employees have a clear view of how their department plays a part in the organisation. As these are though times for the Group, the internal focus is probably more directed towards keeping the Group afloat, which is reflected in the interviews:

> ”Our overarching goal is to make sure the Group is competitive in the market. Therefore we have to do the best purchases with the best content to make sure the Group is competitive.”

Another employee said the following about his department's goals:

> ”I work in the project department of the Yard, and our main goal is to deliver on time with the necessary quality.”

It should be pointed out that the focus of the employees is mainly directed towards delivering on time and with value. None of them mention innovation as a key deliverable. It seems that the main focus of the employees is to contribute to keeping the organisation viable, especially short term. It might be difficult to keep a long term strategy in mind when the Group is struggling with its profitability. This perception is supported by a representative from the R&D Department:

> ”This is correct. As most of the literature suggests, innovation functions must be separated from daily production activities. The parties you have interviewed relate to ”production”, and their objective is to make sure the projects are being carried out”

One of the principles of a viable system is that the S5 function should ensure that the operations are in line with the ”ethos”, or the vision and mission, of the company. But as explained by the representative from the R&D Department, it does not seem be a cause for concern that the employees we have interviewed did not mention innovation when asked about their department's overall goal.

Another principle of a viable system is that S5 should share identity with S1, and they should not claim to be something different (Flood and Jackson, 1991). Based on the empiricism on how present the family owners are in the daily operations and the employee's impression about it, it is argued that S5 shares a strong identity with S1. The board of the Group consists of eight members, where three of them are from the family that owns the Group. All three have different positions in the different subsidiaries, and have many different responsibilities:

> ”We are family owned, so the chairmen sit with many hats [Norwegian expression for having several roles], and they are very involved”

The fact that the family is involved in all the subsidiaries, makes their presence clear for both the employees of the Group, but also the environment. The fact that the Design Department and the Yard are both profit seeking subsidiaries might create some challenges for the family. This came up when asking the Supplier about how they think the communication can be hampered between the Design Department and the Yard when they are both result-driven subsidiaries:

> ”Absolutely, yes. You should watch your step, to put it like that. One of the owners, for example, has several important roles in the different firms. He often has to change between the different roles - put on a different hat - and that can be difficult[...] This is something we know exists in the Group, and I think they are also aware of the problems it might lead to.”

Even though their strong presence can create some difficulties, it also seems to create a strong identity for the whole system that makes up the Group. In every interview that was conducted, the fact that the company is family owned came up at one point. The board is perceived by employees as being very hands-on:

> ”They are very hands-on, because most of the board is made up by owners and employee-representatives from the company. Two of the family owners are very active in the Group. And of course, some of the other siblings are not that involved on a detailed level, but they are still very involved. So in that sense we are very much a family run company.”

This is even considered by some to be their biggest asset:

> ”Our biggest strength is that we are a well established family owned company. We have long traditions and many talented people. There are many opportunities, and the family has invested large amounts of money in to this.”

The fact that the Group is family owned appears to be an important part of their ethos. S4 brings together internal and external information, and captures relevant information from the systems total environment. Their ethos - being family owned and responsible for the local community, as well as forward-looking - seems to be well communicated through S4. Both statements from the environment and S1, S2 and S3 give the impression that the Group's ethos is perceived by both internal and external stakeholders.

5.1.6 The environment

The interaction between the company and its environment is an important aspect of the VSM. Every division has its operational environment which consists of stakeholders like customers, suppliers, consultants, classing companies, shipowners, shareholders, banks, competing companies and the surrounding community. These all become a part of the Group's every day activities through its core activity of delivering ships. The environment as a whole represents both opportunities and threats for the Group.

The Group is dependent on good communication with both suppliers and customers during a project. The Supplier explains:

> ”In most cases, the communication between our technical people and the Yard is quite frequent. It is usually a good communication flow [...] Especially when we are talking about new things, the yards are dependent on good and close support from their suppliers. The maritime environment here is very small, and we are all a part of the same cluster, so we all earn on that everyone does well.”

This statement underlines how the Group operates in a different context from many other companies in the ETO-industry. The cluster effects that are described in Chapter 2 influence the way the Group relates to its environment. The supplier describes how this changes the terms for competition and price negotiations:

> ”They are dependent on a number of suppliers in their close surroundings, and everything else that comes with a maritime cluster. Everything from financing, consultants, suppliers, all of it, they cannot always push them too hard on prices. They are dependent on our survival, because if we do not survive, they can't deliver the ship, and we can't provide service after the ship is delivered.”

This shows how they are reliant on their cluster, but also how they gain from being a part of it. This is defining for the Group's environment.

Another defining feature of their environment seems to be that they are a family owned company located in a small local community in a fjord in Norway. The county count approximately 8500 inhabitants in the first quarter of 2020 (Statistics Norway, 2020). The

number of employees at the Group varies with projects and seasons. According to their annual report of 2018, the Group had 539 employees at the end of that year, thus being responsible for a large part of the working force of the county. This was recognised by the customer when we asked about the effects of being a large family owned company in a small county:

> ”They are very dedicated. I think it has a positive effect, absolutely. It probably goes both ways, when a family runs such a large business in such a small place. They must feel a large corporate social responsibility! I think its impressive how they managed to get through the crisis.”

However, it is not always seen as positive to be located in a small local community. One of the employees explains:

> ”It is written in the news paper every time we succeed with getting a new project. Luckily not every time we fail. But you are always under scrutiny of the ”rural community beast” [a Norwegian saying that is used to describe the sharp social control that can be experienced in small communities].”

According to a manager, another negative side related to the context the Group operates in is during downsizing:

> ”There are a lot of things you don’t talk about. In these days we have had lay-offs and downsizing, which is much tougher in a small community than in Oslo, for example. You are firing your neighbour, and that can become personal in a way.”

A positive factor of living in a small community is described the following way by another employee:

> ”A lot of families work in the Group. They may work in different departments, but the communication between them binds the company together, and is quite informal”

These quotes show the complexity of running such a large company in a small town. This seems to affect the way choices are made and things are run in the company, both for good and bad:

> ”It leads to that you have to develop the organisation in a different way than you can in large international firms. There are a lot of things you want to do, but you can’t. You have less flexibility.”

We have seen that the Group is largely affected by its local community, the cluster and that it is family owned. The impact from the Group’s environment will hence be discussed in several of the following chapters.

5.1.7 Information flows

By categorising the information flowing around in the organisation into the six different vertical communication channels that are described in Section 2.2.5 we could analyse whether the channels give sufficient requisite variety for what needs to be controlled. In this section, each of the communication channels are addressed, underlining the most important findings from each of them.

C1: Facilitates transmission of instructions and corporate standards from the meta-system to the operative management

This is also known as the corporate intervention channel (Hildbrand and Bodhanya, 2015). When analysing this channel, we studied if corporate standards and instructions were communicated well enough for the operational units to follow them. We argue that the board of the Group is in a special position to communicate this type of information rapidly to the management of each subsidiary. This is due to the hands-on owners of the company being alternating chairman of the boards in each subsidiary. In this way, it can be secured that both corporate standards and ethos are well communicated and followed. This reduces the requirements of C1's capacity to channel information from the meta-system. However, we were also interested in the two-way communication in this channel, and question whether the communication from the operational units and back to the meta-system is satisfactory. It seems that the operational units are aware of the capabilities of the intelligence-function in the company, as information flows back into the meta-system. A representative from the R&D Department stated:

> "There is always a new project coming, and we get inquiries from our subsidiaries, or our business areas. At least two each day. Then we try to answer them before the end of the day. At the latest the day after"

To fully utilise the intelligence function in the company, there should be transparent information sharing between S1 and S4. Based on the interviews, our impression was that the operational units hold much information about the environment, which may be key data for the S4-function. As quoted in 5.1.4, this information is to a limited extent forwarded to the intelligence function. An employee from the intelligence function explained why this may be the case:

> "There are some practical limitations here that should not be underestimated"

The practical limitations the S4 representative was referring to, is the physical distance between the subsidiaries. The Group is located in three different offices in the small town, which in several cases seems to be hampering the communication flow. Nevertheless, there already exists IT platforms for such information to be immediately available, and the S4 representatives mentioned the CRM (Customer Relation Management) system as a place where this information should be accessible. This was one of the platforms we noted could have potential to be utilised better, as it seemed that much of information was stored here. Therefore it was surprising that the employees from different functions were not familiar with using it. As quoted in 5.1.4, the intelligence function did not use the CRM for their

own knowledge development either. Our perception is that the poor use of CRM restricts the information flow up to the meta-system, as representatives from the operations may think that this is already in the hands of the intelligence function. Hence, when looking at these findings in retrospect, it should be noted when analysing the C1 channel that there seems to be a small restriction in the communication flow from the operational units to the meta-system.

C2: used for resource provision and resource bargaining between the operational units and the management for accountability purposes

As aforementioned, from a financial perspective the meta-system has a close and satisfactory follow-up of the subsidiaries. They follow a reporting schedule where they have to report 10-12 times each year. Hence, we argue that the C2 channel fulfils the requirement for accountability purposes. When we asked company representatives about resource bargaining, it seemed that this was not crucial, at least not in a short term perspective. But as shipbuilding projects last for a long period of time, people and resources will naturally change along the way. Resources can easily be gathered if there are any necessary adjustments. A company representative gave us insight into the accessibility of their resources:

> ”We do not change much resources from project to project. If we need people, we will just get them externally or internally. We have done that many times.”

Which gave us the impression that a lack of resources has not been an issue in the Group. Another employee who works with sales supports this statement:

> ”In my opinion, we who work in the Group are privileged, because we are allowed to spend the means that are necessary to win contracts.”

Based on the employees' feedback on how easy it is to access resources, it seems that the C2 channel is properly designed for its purpose.

C3: facilitates communication between the operational units

As the subsidiaries in the Group are physically distanced from each other by being located in different buildings, the importance of IT-systems to ensure a proper C3 channel increases. After conducting the interviews, a number of communication tools were categorised as being important for the C3-channel. For example mail, Sharepoint, Yammer and Microsoft Teams was used for communication on a daily basis. This use has recently increased due to the Covid-19 outbreak. After explaining about all the tools the sales department in the Yard uses to communicate with the other departments, an interviewee adds:

> ”Sharing of information is - I will not say that we are good at it - but we certainly do it a lot.”

Additionally, the new Microsoft Dynamics ERP and CRM systems facilitate the transmission of information between departments without people having to meet. This was one

of the platforms we saw had potential to be exploited even better. We therefore asked the same sales representative about the facilitation possibilities this tool offers for more transparent communication with their customers:

> ”It is only used for the Group, but of course there are opportunities to for example start sharing projects with the customer so that the documentation relevant for the customer can be shared through this system. We have not been any good there, mail is still our main communication channel. We clearly have a lot to gain from developing the CRM further and simplify it to get a better overview. Both internally and for customers, since there is a huge amount of information when we first start a project.”

In this case, empiricism supports that the CRM can be utilised for better information sharing with customers. In C1 we saw that it could also facilitate information sharing between the operational units and the intelligence function. As will be elaborated on later, it can also be of importance for transferring information between tendering and the execution phase. These findings warrant discussion with company representatives on the utilisation of this IT-platform, and will be elaborated on further in Chapter 6 Discussion.

Based on the empiricism, we argue that the necessary platforms for communication in the C3 channel are in place, and this is not what troubles the communication. As mentioned, the communication is rather hampered by the fact that much of the information is sensitive between the Design Department and the Yard. This relates to that both subsidiaries are profit-centres and at one point in their collaboration, they have to start bargaining on prices. A lot of information is also sensitive as both the Design Department delivers projects to other yards, and that the Yard builds for other design companies. They have to be careful to not share information from these:

> ”One aspect here is that the Design Department works with other yards, and to communicate the information they get from them is quite sensitive. At the same time is the Yard building a boat with a design from another company. Taking this information from this boat to the Design Department is also sensitive. Then it is much easier to use the R&D Department as a bridge between.”

One last aspect seems to in some ways hamper and in other ways facilitate the communication between the operational units. This may not be as common for the Group’s competitors, but their strong position in the local community plays a role in this communication. As stated by representatives from the R&D Department:

> ”There is a formal communication on management level between the subsidiaries, but we live in a small town, and there are many families working in the Group. A brother works are the Yard, the father works in the Design Department, and a sister in the Power and Control subsidiary. This creates a communication that unites the company, it is not so formal.”

They add that this also has a negative side, as there are many things you cannot talk load about. Especially in times when they have to downsize, there are many sensitive issue

areas. When you run a large company in a small city, you have a more personal relationship with your employees, which means that there are a lot of things that cannot be a general theme. One of the representatives from the R&D Department explained both sides of it in a good way:

> ”There are many things you want to do, but which you cannot exercise. You have less tools in you toolbox, but you have a larger industrial area. This influences what is being communicated, how it is communicated and when things are communicated. Organisational development is harder in a more uniform industrial area, compared to what you will recognise where you have more business. Then you will have more flexibility in regards to your remedies and how hard you can push.”

Again, in this case, it seems like it is not the capacity of the C3 channel that is restricting communication between operational units. It is rather the organisational structure and culture that influences it.

C4: responsible for communications in the environment and facilitates environmental communication for the operational units

The Group has three communications channels towards the environment which acquire information of importance for long-term and strategic planning. One of them is the Strategic Purchasing Unit’s contact with suppliers. They are updated on information about the products the suppliers offers, and they also use magazines and the internet to stay informed. In the past years the Group has also had time-consuming visits of suppliers that want to show what they can offer, and these sales presentations have in the recent years been channelled through the Strategic Purchasing Unit. They attend seminars and exhibitions as well. Regardless of all the different means of communication the Strategic Purchasing Unit possesses to stay updated on the surrounding environment, an employee states that:

> ”We spend too little time exploring suppliers, new type of systems and products. We only come in touch with a few of the suppliers that exists. We should spend more time on this.”

We argue that such information may be collected from the two other channels the Group has towards the environment: the Yard’s and the Design Department’s sales people, and the R&D Department. The R&D Department is as mentioned in contact with around five to ten important universities, and is in this way close to where new knowledge is developing. They also hold subscriptions to around four databases that provide critical information for strategic decisions and project based decisions at the Group. The Yard spends much time gathering data from the surrounding environment to follow up current and potential customers. Their information exchange is coordinated through CRM and shipowner meetings. Communication with other external stakeholders, like for example class societies is done through coordinating platforms such as DNV Veracity. Based on these findings, it is fair to say that the operational units have the proper tools and meeting areas to secure communication with the surrounding environment. These are necessary for them to execute local autonomy.

Another factor deciding how good the communication between the operational units and the external stakeholders is, and hence how autonomous the units are able to be, is the constant interaction the environment. This is unique for the Group compared to shipyards worldwide. The maritime companies in Norway are a part of a small and collaborative cluster. This fosters frequent and informal communication with the Group, and when we asked how a supplier considered their communication with the Group, the representative supported this statement:

> ”The communication is good. That applies for all yards [...] The maritime environment is incredibly small and people change workplaces. We are really incorporated and everyone knows each other.”

The supplier adds that everyone in the cluster gains from doing well, and that this fosters good communication between equipment suppliers, yards and ship owners. We argue that this well-established trust in the context where the Group operates adds an important point of discussion when addressing the question of whether the operational units should be granted more autonomy. The effects of the maritime cluster will be further discussed in Chapter 6.

C5: supports coordination processes by connecting S2 to the operational units and their management

Several of the coordination processes, such as weekly meetings and morning meetings seem to be important for connecting S2 to the operational units. The same goes for the kickoff meetings, that are of uttermost importance for coordination between the different operations. Also the Dynamics ERP system appears to be relevant for this information channel. All of the above have been thoroughly explained in previous sections, and will therefore not be elaborated on here. We find that the R&D Department's communication with the other operational units should still be clarified to fully cover C5.

The Group has taken different measures to better coordinate the information flow from the operational units to the R&D Department. As stated by representatives from the R&D Department, this has changed dramatically the last years:

> ”Earlier we had to walk around with 'our hats in our hands' and ask for information, but this is not the case anymore. It is not long since this changed dramatically. ”

Today, the R&D Department has access to all systems in the different subsidiaries, as well as a ”saved seat” in their offices. This changes the premises for coordination between the operational units and the R&D Department, and gives them a variety of tools to communicate with, thus improving the C5 channel.

C6: provides S3* direct access to the operational units

In general, C6 in itself seems to serve its purpose well. The Group appears to have a properly working financial audit function. This function has recently been improved. The following quote has already been presented in Section 5.1.2 and explains how this has affected the accessibility of the budget status:

> ”It has become much easier now, through the new system. We can check the budget status every day if we want to. Before it was more on a overall level, and only a few times a year. But now it is being followed up every month.”

Based on empiricism, it is assumed that S3 has access to this information. The employees' comment seems to be mainly in regards to the departments financial budgets and expenditure, while the more general financial overview is evaluated less often:

> ”In my department we use this new budgeting system a lot. For example, if I have to go to an exhibition it is easy for me to get an overview of how much I can spend - this is updated on a weekly basis through Power BI. But when it comes to more high level budgets related to the turnover in the company, we do not have run-troughs very often.”

The employee believes that this is due to the transparency of the organisation - everyone knows about the projects that are happening, and the status of these. Therefore it is not necessary to go through them that often.

Through interviews with other employees, we have seen that the Group struggles with measuring physical progress of the projects. The empirical data does not suggest that this is because of hindrances in C6, but rather related to other issues that will be discussed in later sections.

A more serious issue related to this channel, is that S3 seems to sometimes intervene directly in to S1. This happens when the owners go in to the operational units and overrule decisions, which is in violation with VSM principles. This might be possible to ameliorate through exploiting the possibilities that exist in C6. By more actively using the information that is available through C6, S3 can communicate what needs to be done through S2, and thereby increase the autonomy of the S1 units, and the viability of the system as a whole.

5.2 System Diagnosis - An agenda for debate

While analysing each of the function S1-S5 of the Group, some issue areas surfaced. We have identified several discussion points that we have brought up as an agenda for debate with the company representatives. In the following sections, each of these are described. Then, a few questions are suggested to ask the company representatives in a feedback session to address these discussion points.

5.2.1 Discussion point 1: S2's role in achieving correct pricing

Pricing of newbuild projects in new market sectors has been a big issue for the Group. A representative from the R&D Department states that:

> "We have not done well with pricing our projects correctly. Understanding the full picture of costing, and how the costs are generated in a newbuild process has been difficult. What is happening in the market that makes the prices fly up is also complicated to understand".

This points towards a lack of understanding the market situation, what they can expect from suppliers, and their own capabilities. That can be accounted to the rapid change in market, as well as new suppliers and new working methods for the Group. To meet this problem, the R&D Department have been developing a pricing model for determining the market price of a newbuild vessel. This is based on several factors including market outlook, contingency cost, profit requirement, and the expected cost of manpower, equipment and commodities.

So far, the model does not seem do deliver correct numbers every time it is used. Through interviews, the sales division has expressed a need for more updated price calculations, so that they can better estimate the price of a newbuild. As we see it, this has two indications: firstly, the sales department does not fully trust the R&D Department's pricing model. They have stated that the model misses on the price too often, and often by a lot. Secondly, there is a need for a more continuous control of price calculations, meaning that this is not communicated and controlled often enough, pointing towards lack of information flow or control upwards. A sales manager has expressed a desire for a more formal evaluation of every step of the process, so that they can base their pricing calculations on actual experience and feedback.

It can be argued that S2-Coordination is more important than ever for the Group if they wish to achieve better pricing models. A more formal evaluation of the projects might be possible to achieve by improving S2. An important philosophy of the VSD is that organisations can achieve their goals through constantly self-questioning, learning and assessing future scenarios in a rapidly changing environment (Flood et al., 1991). The Group's pricing model and their desire to have more continuous evaluation indicate that they are aware of this, and are working towards it.

5.2.2 Discussion point 2: Transferring of information between tendering and the execution phase

One of the revealed oscillation between some parts of S1 is the transfer of information between tendering and the execution phase. A way of harmonising this oscillation and to gain information is by integrating the main functional areas in the tendering process. This can be related to the use of a kickoff meeting held by the sales department in the Yard when a contract is signed and the information need to be transferred to the project team.

The duration of the kickoff is typically one to two weeks, and different meetings are held with both the project manager, the production manager, each of the technical line management, and the financial controllers.

According to a sales manager, this phase, when information is transferred between tendering and execution, is one of the major challenges they have as a shipyard. It has also been argued to be typical for all yards. This highlights the importance of a well-functioning S2 function when operating in new market segments. As stated by a sales manager:

> ”There has not been spent enough time on this earlier, as it has not been as important when we were in offshore. Then everyone knew what was involved in building OSVs, and almost everyone in the organisation had conducted at least one or two such projects before. But now when we are selling vessels within segments we are not used to, this is extremely important. To use just two weeks in prior to the execution, is a much better utilisation of time, rather than using a month to correct mistakes afterwards. So right now, in the situation we have been for the last couple of years, with projects within completely new segments, we should have used even more time in the start of the projects”

Different methods have been tried out to enhance the information transfer between tendering and execution phase. One approach is that the project manager has been brought in as early as possible in the sales phase, so that he understands what has been agreed with the customer. The other approach has been to assign sales people to a project management position. The sales department tries to involve as many people as possible in the final stages of tendering, such as the technical line managers, the production manager and the project manager.

A project manager states that this process is difficult, mainly because it is ”early in the game” and his project team is not even set. This indicates that a lot of both written, and maybe even tacit knowledge has to be transferred through few individuals. The challenge is even larger when operating in unknown markets, as confirmed by a project manager:

> ”It can be challenging for me when I get all the information handed over, especially if I fall short on preparing myself. Especially if it is new a design, a new prototype, where it is a lot of information, many messages, a lot of work that has been done, or bigger equipment deliveries.”

A way of securing better information flow, both in the kickoff-phase, but also generally, can according to a purchaser in the Group be achieved by involving people more throughout the process. He states that:

> ”It can easily be fixed by putting people on email-copy, or that they receive minutes of project meetings or shipowner meetings, so that they can look at it and uncover if something might become problematic later.”

5.2.3 Discussion point 3: Coordination of meeting activity

In all of the interviews it has been stated that there is too much meeting activity in the Group. Interview objects have said that several issues could have been reported and solved via email instead of spending time discussing it in a meeting. A sales manager states:

> ”I think there is too much to be honest. Things can also be decided outside of meetings. Often, there are so many meetings that people don’t have time to work. Instead of working on issues, the same issues that you brought up in the last meeting are being repeated in the next meeting.”

The interview object brings up how there is not enough time to deal with the problems at hand because the meetings take up time that could otherwise have been spent on solving the problems.

On the other hand, it can be difficult to get a hold of people if you don’t schedule a meeting. A sales manager said the following:

> ”Looking at my own calendar, I think there is too much meeting activity. I would prefer to have more office time where I can get some work done, but in stead I have to do that in the evenings. But at the same time, often people are so busy that if you want to reserve time with them, you have to book a meeting. Otherwise it can be hard to get hold of them.”

This points towards that there is a lack of coordination between the different operational units. It indicates too many meetings, too little availability and information that could have been given through other communication channels. In addition to this, some of the content of the meetings has been questioned by an interviewee:

> ”I am not interested in hearing about everything that goes well in the meetings. It is through talking to old colleagues in the hallway that you hear about what is not going as well, things that don’t come up in the meetings”.

The company has, as many others, been affected by the ongoing Covid-19 pandemic, and home-office with Microsoft Teams meetings has become the new standard. We found that several of the workers think they have learned something from this:

> ”That [Meeting activities] has improved now that people have to think it through before they summon a meeting on Teams. In my opinion it has helped a lot with structuring, because before it was very easy to just call for a meeting. You are supposed to do a job, and then you think: it would be good to have this and this person to join me on this, and then you just throw out a meeting invitation. I think this is a bad thing, because we spend way to much time in meetings. I think there has been a sharp improvement on this now.”

The oscillating effects that the overload of meetings have had seems to be damped by the Covid-19 situation. This can be a sign of a meeting structure and meeting behaviour which is not adjusted to the need of the organisation. A common fault found in organisations is that there exists additional features to the structure that are irrelevant and hamper with the viability of the organisation (Flood et al., 1991). These meetings might qualify as such an organisational fault.

One of our interviewees also discussed if some of the meeting activity can be replaced. The interviewee is worried about replacing meetings with emails, but sees the value of other platforms:

> ”Yes, there are many that think all these simple emails that are going around are a challenge as well. There has been a lot of talking about getting on platforms where everyone can take part”

5.2.4 Discussion point 4: Profit seeking subsidiaries reducing the economical viability of the group as a whole

A well known debate about the business model of the Group is the financial structure of the subsidiaries. The Yard and the Design Department are not costs-centres, but profit-centres which have to bargain on prices, and at the same time collaborate in projects. When questioning the information flow between the subsidiaries through the different value creating processes in the Group, it became evident that communication is hampered by their transactional relationship. Higher management states that:

> ”It means that you have to bargain with your own people internally on the final price of a delivery. That is hampering the communication. No doubt.”

The empiricism shows that there is an open communication between the Yard, the Design Department and the R&D Department on opportunities in projects and development on projects, all the way until the projects become more concrete, and as one manager stated:

> ”It goes well until we start discussing things that costs money. The fact that both companies are pressured on delivering results makes it harder to collaborate”

However, a lot has changed throughout the past decade. The interaction between the subsidiaries was described as ”waterproof bulkheads” just 13 years ago. Since 2014, the communication has become more continuous and open. The discussion on how to model

transfer pricing in the company is not new, and it seems to be a reason for the board to keep this business model. An employee argues that having separated subsidiaries provides flexibility:

> ”Traditionally, ship design was one of the integrated parts of a shipbuilding yard. Separated ship design is something more recent. When you order a boat normally most projects are run by the Yard. Some yards have own design departments, others don’t. We have separated ship design, and have had a success with that. Then they can serve customers that do not necessarily need both.”

5.2.5 Discussion point 5: Challenges linked to long term planning and managerial education

In one of our interviews, a project leader brings up the challenges that are linked to long term planning. He talks about that ”you are only as strong as the weakest link”, and that it is challenging to make everyone stick to the plans. Especially the periodic plan, as this has a horizon of around 8 weeks:

> ”I call it ’turning on the high beams’ [Expression for thinking long-term]. We struggle with that people are hesitant to take on a more long-term view of the situation. The foreman meetings have a much shorter horizon, and they are more about day-to-day things that you can physically see. My impression is that they [the workers] are more comfortable with that. To plan well and early in the process is maybe the most important improvement area we have.”

This is a problem as the shipbuilding projects at the Group are becoming more complex. That requires a higher level of coordination between the operations than what has been necessary before. As the project leader mentions, this coordination issue can be damped by planning better further ahead. He explains why this has proven to be difficult:

> ”When going in to a meeting where you are supposed to talk about things that will happen two weeks in advance, you have to be prepared. If you haven’t thought stuff through, it can be difficult, and you struggle with the chemistry of the whole group. You don’t get everyone with you.”

The Group is situated in a small fjord in Norway, and the workforce of the company has a wide variety of backgrounds. It is not uncommon to climb the career ladder from the floor all the way up to becoming project manager. These workers are usually highly skilled in their area, but the transition from one position to the other can be difficult. Management positions might require quite a different way of thinking. The worker has to factor in issues like coordination and strategy to a much larger extent, which he might not have dealt with in his previous positions. That kind of training is often acquired through education or training programs. In the VSM model, S2 harmoniously coordinates the parts that make up S1, and dampens oscillations between the parts of S1. The coordinators and project managers play a key role in this. The project manager continues:

> ”I got that promotion myself, from foreman to coordinator. Then you have to realise that you have a different role. You can not be a coordinator or an assistant project leader and behave like a foreman[...] He can be a good foreman for 10-15 years. If you promote him to become a coordinator, you can lose a good foreman. He was a good foreman, but he might not be that good at thinking long term. So you get a bad leader, and you lose a good foreman”

This is supported by management higher up in the organisation, who acknowledge that what is required from the project managers has increased:

> ”Traditionally we have recruited everything from skilled workers up to foremen with or without engineering background to the position of project manager. That is no longer possible. When the values increase, the requirements for project management also increase dramatically. We are in the middle of this process now. The project managers we have now will get challenges that are too big for them in the future, because it is so complex. We need to find people with more a educational background. People that can follow up, and can understand specifications.”

He also underlines the importance of having a project manager that can plan long term, and how this need has changed over the last years:

> ”Before, project managers were important in the later stages of the projects, but we now see that we have to spend much more time upstream in the projects and plan in advance. We do not have a lot of experience with this, and we do not have a lot of people who know how to do it.”

5.2.6 Discussion point 6: Restricting autonomous operations

The Group is as mentioned a family owned-company with long traditions. This makes them unique in comparison to many other shipyards, and can be argued to have kept them afloat during the market recessions. Many have stated that their principals had a burning interest of developing the company throughout the crisis, and that the company is an important cornerstone in the local community.

Throughout the interviews, it became evident that the family is hands-on in the daily operations of the firm. They have different roles in the group, and have alternating leadership responsibilities in the subsidiaries. According to several employees, they engage in many different decision making activities.

Based on this empiricism, it can be argued that the needed degree of autonomy on the system in focus is violated, leading to the group not being fully viable. According to VSM theory, S3 - which is where the owners operate from - should not intervene directly with S1.

Granting autonomy to the management of the different S1 operations is a major way of

attenuating variety and managing the enormous amount of information that flows in a complex ETO-project setting. With autonomous operational units, they can manage their own decisions immediately and effectively and deal with their own environmental disturbances (Espejo and Espinosa, 2015). Based on the interviews, the practice in the Group seems to be conflicting to this theory. As stated by an employee:

> ”They [the board] are quite hands on. They demand a lot from us as an organisation to deliver projects to right time and for the right price”.

In addition, evidence on lacking autonomy is found to increase the variety in the system. According to employees from higher management, it is acknowledged that project managers need to involve higher management when making decisions that affect the different technical departments:

> ”Because project managers don’t have actual power to intervene in the technical lines. He then has to go up to the top management, which then needs to go down to the technical lines. It is not easy to be a project manager, you need to deal with many different lines, and also many informal governance structures in the organisation.”

It can be questioned whether this is the only way the board can ensure organisational cohesion. Because the units should operate by the same ethos, sustainability values and strategies (Espejo and Espinosa, 2015).

At the same time, when looking at one recursive level lower than the system in focus, it is common for Norwegian shipyards to have high worker autonomy. According to Semini et al. (2018), decisions and changes are often made at the worker level, with little bureaucracy and without any formal requests. With this in mind, we argue that granting more autonomy to the operations of the system in focus may exploit an underlying opportunity. This could lead to that autonomy is achieved across several levels of recursion in the organisation. In this way, the complexity that challenges the whole organisation can be tackled by highly autonomous units, reducing the external variety affecting the company.

5.2.7 Discussion point 7: Lack of coordination in strategic project purchases

The importance of purchasing in a yard is evident. Through our interviews we have seen that several employees are concerned about the way purchasing is handled from a strategic perspective. From the upper management:

> ”Those who work with purchasing are essential to land the final prices with our suppliers. But it may be that they have too little understanding of the total strategy of the projects in the Group. They might negotiate prices on a component without having any strategic understanding of the importance of that component. The importance of course varies a lot from project to project. There is a need for more communication and training on where time should be

> spent. We are lacking in this area. We handle most purchases in a similar way, no matter if they are worth half a million, a couple of millions or hundreds of millions. It is important to keep track of these differences."

It is clear that this is something the Group has tried to mitigate, as they recently created the division "Strategic Purchasing Unit". This unit should be responsible for all strategic purchases, meaning expensive and important components of the projects. However, this does not always seem to be the case. It appears to vary from project manager to project manager how much they choose to exploit the expertise of the Strategic Purchasing Unit. A purchaser says the following:

> "We in strategic purchasing see that, in some projects we are in the loop throughout the project, and we are being used as a resource. We contribute with the main equipment in an early phase and in the handover. In other projects the project manager doesn't share anything, and then it is hard for us to help."

The same purchaser points out that lack of coordination has lead to unnecessary work:

> "Sometimes the coordination is lacking in sales projects. We might have a lead on a project that we are all working on, and then the project 'dies out', without this being communicated to us."

He also says that his job becomes much harder when there is not enough communication:

> "A project that is being started up that you don't know about before you are supposed to hand in an offer two days later, then you do not have the possibility to do a good job, with such short time horizons. I think we could do better if the Group had a more holistic view, and we were able to use our time better."

We are also questioning whether the Strategic Purchasing Unit is included enough in the strategic decisions of purchasing. This can be a sign of lacking local autonomy, and might be due to the organisational structure:

> "I report to my boss who is CEO of the Yard. I have a good dialogue with him and he is a part of the corporate management, and he represents purchasing there."

Another important area of purchasing mentioned by several purchasers, is the fact that they are not in contact with enough suppliers, and are not familiar enough with the new market segment suppliers. Another purchaser says the following:

> "We should have been more proactive in the supplier market in the cruise segment. Then we would have had a better overview of which suppliers supplied what, and we could have connected with new suppliers. We have struggled a bit with finding the best suppliers to our new segment"

The strategic purchaser adds on to this:

> "Maybe we are spending to little time exploring new suppliers, systems and products. We are probably just scratching the surface of all the suppliers that are out there. We should have spent more time on that".

5.2.8 Discussion point 8: Control of project progress

Based on the empiricism, it seems that S3 is well-functioning when it comes to auditing and control for accountability purposes in the Group. An employee from higher management states that:

> ”Financially, we have a thorough and proper control of the projects.”

However, even though the company follows a QMS audit, it becomes evident that they fall short when it comes to controlling the physical work in progress, which may have had a large cost impact on the company:

> ”The main problem is that we are too weak with, and we do not actually have proper measures for physical progress in the projects. We cannot measure when things are done, and this is something we want to improve, by developing a system to measure physical progress. We have been focusing on the financials rather than physical the composition. That has costed us hundreds of millions. Something needs to be done, and it is urgent.”

The problem does not seem to be in the S3* auditing channel, but rather that the organisation is lacking a strong S3 Control function. This is supported by higher management, which claims that:

> ”We have our paperwork in order, but our consciousness and focus on following up the procedures has not been as strong. We have probably incurred losses that we could have avoided. But I will not say that we are worse or better than anyone else. But we are not very procedural. The whole industry is more practice-oriented. You just copy what you did the last time.”

5.3 Discussing the findings with company representatives

As all the steps suggested by Flood and Jackson (1991) to be followed in a Viable System Diagnosis are completed, the next step is to return to the organisation and the informants to see if the findings resonate with them, also known as "member checking". We were able to go back to the Group to discuss our findings with two of our informants. One of them has an educational background in systems theory, which we found to give the feedback session more depth. We decided to rephrase some of the discussion points in to questions. On discussion points number four and number six we simply presented the main takeaways from a VSM perspective to the informants, and noted down their reaction. For the rest, the questions presented in the next paragraphs were asked to stimulate dialogue over the discussion points that were revealed. Our findings could be compared against the principles of a viable system based on their feedback. This provided the basis for our discussion in Chapter 6 on to what extent the activities in the Group are in line with these principles. First, we introduced the discussion points with a rhetorical and wide question, which was not meant to be answered, but rather to spark interest. Then we have listed the questions we directed to the representatives.

Discussion point 1 - a challenge linked to S2 coordination
Several employees stated that pricing of projects has been challenging for the Group after they entered new markets. Could this be because of a lack of coordination and formal evaluation, implying that the S2 function should be strengthened?

- What information is needed to improve the pricing of the Groups projects?
- Is it possible to provide a more formal evaluation of the projects along the way, so that this can provide input for the cost calculations?
- Are there any routines in place for using the pricing model?

Discussion point 2 - a challenge linked to S2 coordination
The transfer of information from the tendering phase to the sales phase is a large challenge for most yards. How can the Group improve their kickoff meetings, improving the coordination between these phases?
- Would there be a way to standardise this phase that can secure more control of the information transfer?
- Do you believe the IT platforms that exist in the Group can be exploited in a better way to improve information flow?

Discussion point 3 - a challenge linked to S2 coordination
Close to all interviewees stated that there is an abundance of meeting activity. How can this be reduced, and could it stem from the lack of autonomous operations?
- Are there some decisions that can be made outside of meetings in stead?
- Is there a culture for postponing decisions until meetings?

Discussion point 4 - a challenge linked to the information flow
In our diagnosis, we saw that the Yard and the Design Department are both profit seeking subsidiaries, and the communication and synergy effects are limited. According to theory

on viable systems, such a bargaining situation can undermine both coordination as well as control.

Discussion point 5 - a challenge linked to S2 coordination
Long term planning has been challenging for the Group, especially for employees who have been promoted to positions that require them to think long term.
- How can you ensure that someone with leader responsibilities manages to think long term and strategically?

Discussion point 6 - a challenge linked to S5 policy and S3 control
The Group is family owned, does this lead to the owners involving themselves too much, and restricting the autonomy of the company? According to VSM theory operational units should be granted enough autonomy to deal with the variety imposed by the environment, without having to involve higher management.

Discussion point 7 - a challenge linked to the information flow
The strategic purchasers of the Group do not always seem to be coordinated in an optimal way. Is the Group exploiting all its resources, like the Strategic Purchasing Unit? This may be linked to the other problems stemming from lack of long term and strategic planning.
- How can you ensure that the Strategic Purchasing Unit is continuously informed about projects that are relevant to them?

Chapter 6

Discussion

In this chapter we will sum up the analysis of the Group by comparing our findings to the principles of a viable system. These insights will ultimately contribute to answering the overall problem statement, which will be concluded on in Chapter 7:

How can Norwegian yards become more viable in increasingly complex markets?

With the aim of finding an answer to the purpose to be pursued in this VSM, and hence provide insights that can contribute to the overall problem statement, we will in the following sections ask ourselves:

Are the activities of the Group in line with the principles of a viable system?

As argued in Section 4.2, this purpose will only be used to guide the viable system diagnosis of the Group. Some of the findings presented are argued to be closely related to the Group violating principles of viability, while others are more general findings that surfaced when using VSM as a tool for analysing. The issues we found will therefore be linked to each other as there seems to be an overarching issue between them. The discussion points are thus summarised into three viability violations: **bargaining subsidiaries restricting the communication and information flow, the lack of autonomous operations leading to extensive meeting activities, and the coordination function should be improved to handle necessary information flow**. The ensure clarity for the reader, the title of each of the following sections summarises the violation. This exact summary is also repeated in the conclusion chapter.

In each of the following sections, a brief discussion on how the Group is deviating from the principles of viability is also given, arguing why they were brought up as an agenda for debate. Then, each statement is discussed with company representatives, giving us insight into how these issue areas are viewed from the industry perspective. Comparing our findings with the feedback from company representatives underpins our discussion for

answering the overall purpose of this VSM.

6.1 The subsidiaries are profit seeking and have a bargaining relationship that seems to hamper their collaboration in some phases of the shipbuilding process

This viability violation is related to information flow. When analysing the communication between the operational units, it became clear that the collaboration is hampered by the fact that each subsidiary is pushed to deliver results. Therefore they need to bargain on prices and resource utilisation with each other. Another aspect is that both the Design Department and the Yard possess a lot of information that would be sensitive to share amongst themselves. From an industry perspective, it would be interesting to see what viable systems theory says about this way of organising a company. As such bargaining may undermine coordination and control principles, it is of interest to provide insight to the VSM theory from an industry point of view on this issue area, and it was thus discussed with company representatives.

Discussion with the company
The company representatives did not recognise this issue as being unique, and replied the following:

> "This is not very special. But the main point is of course correct - bargaining within a company has lots of consequences and implications. Maybe we have been extreme when it comes to autonomy between the different subsidiaries. There have been "waterproof bulkheads" between them - they exchanged close to no information before."

We have learned through our interviews that even though it is still a problem, the communication has improved over the last years. This situation comes with two large consequences. Firstly, the Group is not able to exploit all the resources of the subsidiaries, and synergy effects are lost. From an organisation point of view, the Group has built up too many resources in the individual subsidiaries. And secondly, the situation does not build a culture of unity. But, as one of the representatives points out, this might be outweighed by the small town-situation:

> "There is a formal communication on management level between the subsidiaries, but we live in a small town, and there are many families working in the Group. A brother works are the Yard, the father works in the Design Department, and a sister in the Power and Control subsidiary."

We discussed how this informal communication might help unite the employees of the Group, and if this could substitute for the lack in communication between the different subsidiaries. This unique situation might contribute to communication that is not well

captured by our VSM diagnosis, as it happens outside of the workplace and the working hours. The next step in our analysis would be to interview employees on how this informal communication affects both them and the Group. As we found that the local community largely affects the operations here as well, it is interesting to balance this against the principles of a viable system.

6.2 The lack of autonomous operations seems to create extensive coordination efforts in meeting activity and affects daily decision-making

This viability violation is linked to both S2 coordination, S3 control and S5 policy. One coordination mechanism that is clearly present the Group is meeting activity. Almost all of the interviewees mentioned the abundance of meetings as time consuming and distracting. This makes us question whether the operational units lack autonomy, leading to employees involving higher management in decision-making, which in turn increases the number of meetings. As empiricism shows that the owners of the company are very hands-on in the daily decision-making, it can be questioned if this contradicts the viable systems theory on how the operational units should be granted autonomy to reduce the variety. Both the issue of abundant meeting activity and the issue of restricted autonomous operations was discussed with company representatives, as it seemed to deviate from the principles of a viable organisation.

Discussion with the company
Through asking the questions related to discussion point number three, we had a fruitful discussion with the company representatives on meeting activities and the autonomy of the operations. We started with introducing our general finding of there being too many meetings. One of the company representatives had some initial thoughts on this:

> ”In my opinion, we have too many meetings, and too few workshops. We need to convert meetings with talking into workshops with discussing, working and decision-making.

The manager in a high position adds on to this, and we got the following answer from him:

> “I do not believe we have many more meetings than other companies, but we do have way too many people involved in every meeting, which is a big problem - the meetings almost turn into seminars!”

This made us aware that it might not be the amount of meetings that is the problem, but rather the content of the meetings and how many employees that attend every meeting, which in turn makes the number of meetings per employee go up. Through further discussions with the company representatives, we have identified three key factors to why so many employees get unnecessarily involved in meeting activity. Firstly, many employees

do not seem to fully understand how organisational democracy should work; not everyone has to have a say in every decision. This is partly related to the next factor, namely that people seem to be afraid of making decisions. The company representative refers to this as that people want to "cover their ass". It seems that many employees are indecisive, and do not want to take a wrong decision that leads to unwanted results. We had actually prepared a question for the feedback session on exactly this problem, but the company representative brought it up himself, which shows that the findings clearly resonate with their experience. The last key factor we discussed was that some employees seem to lack both experience and competence to take decisions. This makes it harder to understand and predict the consequences of their actions. This discussion answered both of the questions we had that were related to "discussion point three"- if employees were indecisive and if some of the decisions could be taken outside of the meetings instead.

Next, we steered the discussion towards our other findings within the area: Is the abundance of meeting activity a result of restricted autonomy? We brought up the fact that the owners are highly involved in the day-to-day operations, and that this might lead to employees taking less decisions independently. The representatives agreed with this:

> "It's very easy to get 'caught', because our owners have very detailed knowledge of our operations, often they know more than the employees. It can almost be a bit frightful, and sometimes they probably misuse their power. I don't think they mean to, but it is their style to make sure that if people want to give their opinion, they have to make sure they know what they are talking about. This is definitely a dimension, that people are afraid to have to many opinions, because they know that our owners have good insight in everything, and people are afraid to make a fool of themselves."

This statement relates well to our discussion with the representative on how people want to "cover their ass", and shows how an abundance of meeting activity and restricted autonomy can be connected. We discuss the effects of the owners being involved in day-to-day operations:

> "The boards of the different subsidiaries have been functioning more as a collective CEO with the two owners as the main decision makers... Our owners intervene when the CEO does not meet their expectations - either by virtue of being chairmen, board members or owners."

Through our discussion it becomes clear how this has been both good and bad. Having the owners decide can be very efficient for making fast decisions, but it is not a good way of developing leaders and letting them grow. We bring up how this is in violation with the principles of a viable system. The representative responds:

> "Due to the bad market situation, the owners have chosen to be close to the operations of the Group. When we have to adjust our strategy on a weekly basis, it is practical to have our owners close to production, so that the "distance" to finding out what is acceptable and not is as short as possible."

We continued to discuss how they hope that this can lead to more discipline in the different subsidiaries. But on the other hand they also acknowledge how this might not be the best way to run the operations, with the owners scrutinising the employees' every move. We discussed the difficulties of going from this management style to a more portfolio type of management:

> "We are in the process of loosening up a bit more, because our owners want to get back to helicopter management, like we used to run things several years ago. But we have to see how that goes, because it is difficult to recruit a new CEO here in the small town - and we need the right people to run the shop"

The choice in management style is a constant trade-off. During the interviews it became evident how important the efforts of the owners have been. Regardless of the different approaches that have been attempted in the Group, they have tried to run the business as a part of a bigger picture in the local community of the Group and the whole maritime cluster. This points towards what we have already seen, that being situated in a small local community changes some of the premises for running the company. As the company representative puts it:

> "You have less tools in your tool box"

By this he is referring to how many of the people in the local community work in the company. This leads to that the company has less influence over what is being communicated amongst people. He also points out that organisational development is much more challenging here than in larger cities, where you have more flexibility and access to resources. All the choices that are made become highly visible in the local community. In companies in rural areas it might be more widespread that people avoid making decisions as they do not want to make decisions which may lead to bad results. A company representative which has worked in larger cities before explains that this is more common amongst the companies in the maritime cluster in Western-Norway, compared to what he was used to from before. As companies such as the Group are important cornerstones for the local communities, people want to "cover their ass" when making decisions. We discussed with the company representatives how this is in violation with the principles of VSM. It seems like even though only a few people are granted enough autonomy to make daily decisions, the culture of the community is that "everyone" takes part in the decisions.

We also wanted to discuss how the meeting management can be improved. We talked with the representatives about how every meeting should achieve a goal, referring to that if there are problems with a meeting, the meeting often has no goal, or the goal is not being achieved. This resonated with the company representatives:

> "There has been a weak understanding of meeting management. What is to be achieved, who should say something, who should not say something, what is the conclusion, and who should follow up - the classic basic elements of meeting management have not been good enough. There is no tradition for structuring the meeting - 'you should not come here and think you know stuff. You should not think you are in control of the meeting'. We have some of

> that culture here [...] Our owners are sharp in meetings. They demand well managed meetings with the right content. This culture has unfortunately not spread to the rest of the company."

Based on this statement and the above paragraphs, it has become clear that the Group has potential to improve their meeting activity, and thereby creating a better functioning S2-coordination. The indecisiveness of employees and scrutinising leadership seems to hamper with the autonomy of the different operations, and the company should consider how they can motivate people to take more independent decisions. They are heading in the right direction towards a more portfolio management of the subsidiaries, and the insight from this analysis underlines the importance of this strategic change.

6.3 The coordination function should be improved to handle necessary information flow

This viability violation is related to coordination. Based on interview responses, our impression is that the S2 coordination function is increasingly important as the Group has entered new markets. This is partly because we found that during the times when the demand in offshore markets was high, some of the projects where run on "autopilot", reducing the need for coordination mechanisms. The company and the handling of risk and complexity relied, to a large extent, on the tacit knowledge and experience of employees. We argue that some of the issues we pointed out have an oscillating effect in the company, which can be reduced by enhancing the S2 function. One of the hindrances that oscillates variety in the Group is the difficulties in transferring information between the tendering phase and the execution phase. The transfer is handled through a kickoff meeting, which is a S2 measure, but this does not seem to be sufficient. As an employee mentioned, this is something that they also did on "autopilot" back in the days, and they did not focus on how to coordinate this well enough as projects were waiting in line when the OSV market was still good. The workers had already conducted one or two of the similar projects, and a lot of tacit knowledge was therefore present. Hence, a more thorough S2 function needs to be in place to coordinate this troublesome phase of shipbuilding.

Next in line of oscillation effects in the company that could be harmonised by the S2 function, is the troubles they have experienced lately in pricing their projects correctly. The sales department needs continuous inputs from the project controllers to improve their pricing. The financial controllers are argued to be a part of the S2 function as they get feedback from the projects and provide inputs back into the sales department, which has a coordinating effect on the pricing. The same goes for this issue area as the one from the previous paragraph, it was not equally necessary to coordinate this during the good market situation. As mentioned by some of the employees, a more formal evaluation is needed for to deal with this problem, which is clearly a mechanism within the S2 function.

Discussion with the company
Both the difficulties related to information sharing between tendering and execution phase and the pricing issue was discussed with the company representatives. With the intention of looking for how a S2 function could be enhanced to meet these issues, we asked the questions related to discussion points one and two found in Section 5.3.

Pricing
When it comes to pricing, we wanted to get a deeper understanding of what is necessary to price more correctly, to see if this is something that may be related to coordination. To answer our question on what is necessary to enhance the pricing, the issue could be related to three elements:

1. A need for better understanding of the market price level. This challenge is clearly related to the fact that projects were run on "autopilot" during the good markets, but also the high purchasing power amongst shipowners during that time.

> "The market price is set by the industry. It is an inadequate understanding of this. An overview of the market is necessary to calibrate the price, you will never sell anything significantly above the market price. We have been through a booming period where we could sell things to whichever price. We have not adjusted our thinking in pricing after the recession in 2014."

2. A need for more updated unit costs. These are not continuously updated, and an evaluation of former projects are neither properly done nor properly followed up.

> "We do not update the unit costs of installing a propulsion system or engine system. When you underestimate the cost factors along the whole way, it will eventually aggregate to a big sum. It is both a mentality problem, but also we have bad routines in verifying the unit cost numbers. We have changed markets and used the unit cost indexes for offshore boats on new type of boats."

3. One last element affecting the pricing is the underestimating of the volume. This challenge relates to the fact that the yard faces new learning curves as it established itself in new market segments.

> "We are not able to see the consequences of volume and type of ship. For example on the cruise vessels, we have big problems in computing the cable laying properly. We are really good at it, and have our own people working on it, but there are an awful lot more kilometres of cables in a cruise vessel."

By looking at these elements from a VSM perspective, we argue that an enhanced S2 function can help forwarding necessary information to the correct department, at the right time. A coordination mechanism is needed both to transmit information that different functions in the Group possess about the market prices, but also to facilitate continuous evaluation from both former projects and ongoing projects. Updated unit costs and learning done on new vessel types can then be transmitted to the sales department. This led us to the next question we had, asking whether it is possible to have a more formal evaluation along the way in the projects to give better inputs to the price calculations.

> ”Yes, and we are already doing it. Today we have completely new prices, since we have developed something here in the RD Department [referring to the price model], so today we are calculating it. We have a good overview of the market calibration, and we have completely new unit cost factors.”

It seems that the Group is already working with more evaluation to update the pricing calculation. Still, one of the employees raised the need for a more formal evaluation to enhance the pricing. We questioned whether the problem is that they have lacking routines on using the developed pricing model, which was confirmed by one of the company representatives:

> ”We have implemented routines on it, but it is still dependent on the persons using it. Now we are lucky to have many people involved in the pricing, even the owners are a part of it. It will take a lot to miss on pricing in the future. We may not sell to the price, but we will not miss.”

Empiricism shows that the sales department in the Yard holds relevant information for the pricing model, and that they are in a close dialogue with the RD Department to calibrate the tool. But there is still a need for a formal evaluation both when the projects are completed, and along the way. As an representative from sales expressed it:

> ”We work on projects all the time, so we have to collect data and relevant feedback from projects in execution to use it in the next calculation.”

This is where a S2 function could coordinate the evaluation of projects in execution phase, and transfer information from the operational units to the intelligence function developing the pricing tool. Our impression is that the S4 Intelligence function considers the evaluation to be satisfying, while the sales department in the Yard have other opinions on who should be included in an evaluation and what should be considered. Their contributions may give new insights into how the information flow should be coordinated between the functions, so that updated inputs to the price calculations are forwarded. Relocating the bid manager to the financial department in the Shared Services indicates that they are working towards coordinating necessary information, which we argue strengthens the ”upper loop” of the S2 function. As the project progresses, the unit cost factors becomes important information. This information is flowing around in the S1 operations design/engineering, procurement, production and commissioning, and the coordination should therefor be strengthened in the ”lower loops” as well. The loops are illustrated in the figure below.

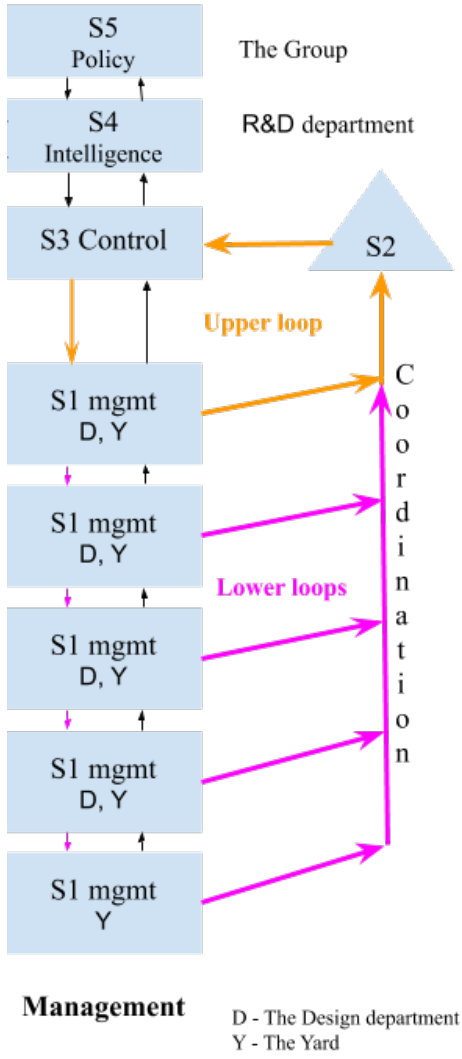

Figure 6.1: Upper and lower coordination loops

Tendering - execution phase

Another coordination mechanism we outlined in the S2 function was the kickoff-meeting. This is argued to be inadequate for the large amount of new and unfamiliar information that needs to be transferred between tendering and execution phase in projects for the new market segments. Earlier, each management function of the different S1 operations had experience with projects, as everyone in the organisation had executed at least one or two projects of a similar type. The phase when projects got handed over from the sales department in the Yard to the project managers was not properly coordinated. But as an representative from the sales department expressed it, this phase is more important than ever before:

> ”But when we sell boats within segments we are not used to, it is extremely important. Spending just two weeks in advance of starting the execution phase, is way better utilisation of time, rather than spending a month fixing problems afterwards. So right now, in the situation we have been in for the last two-three years with projects in completely new segments, we should clearly have spent more time on the phase between tendering and engineering.”

We argue that this troublesome phase of a shipbuilding project oscillates the variety in the Group, and it is also argued that the oscillation can be harmonised by improving the S2 function. In this case, it is also the ”lower loops” of the S2 Coordination function that needs to be strengthened, as project managers execute projects covering all the value-adding operations after the tendering phase. It is not coordination with higher management, for example from S1 to the meta-system, that needs to be managed, but rather that information runs smoothly between the operational units. During the interviews, our perception was that the different departments, and even different people, used various methods to transfer information as smoothly as possible. This led us to ask the company representatives if there existed a way of standardising the information transfer to control that all necessary information is forwarded. Their response showed that our findings resonate with how the representatives perceived the situation:

> ”Yes, we can improve this to a large extent. It is correctly observed that there are alternating practices on the different projects. This may partly be related to the different subsidiaries have employees that are close, which makes them forget from time to time to clarify the relations between them, especially the information relation. Things happens under time pressure, and sometimes it is agreed to initiate things before the transactional agreement is formalised.”

As many other decisions in the complex projects of the Group, this is also a constant trade-off between costs, resources and time spent. According to the company representatives, there is supposed to be well-defined working procedures on documents that have to be in place before starting the next phase. Especially between the Yard and the Design Department in the engineering and production phase, which often happens concurrently in shipbuilding projects. However, as employees in the Yard and the Design Department are ”friends of friends” as an representative phrased it, processes are allowed to be initiated before everything is in place. In this way, the yard can get started on projects to win time. But there is as mentioned a trade-off:

> ”It has consequences and implications. But we can live with it. The problem is that the more streamlined the processes are on paper, the more resources and time is used on the actual transaction documents, which imposes a cost. This cost adds to the delays. We can say that we have agreed standards on how things should be transferred, but they are not always followed.”

As a lot of decisions are done under time pressure, the project management team is not even set before a lot of the information is transferred from the sales department. In addition to standardising the methods as an attempt to improve the coordination of this troublesome phase, we argue that the ”lower loops” of the S2 Function should be strengthened here as well to ensure a smooth information flow. In this way, as the project develops in the execution phase, all necessary information can be communicated to the different operational units and to the project management team along the way.

6.4 General findings when applying the VSM

Not all our findings are directly related to the Group's deviation from an ideal VSM structure, and this paragraph discusses those findings. Throughout the interviews we encountered three issues which do not necessarily emerge from the organisational nature of the Group. All the issues could however be related to a common denominator: challenges in strategic planning. There is a lack of control of physical progress in projects, which reduces the opportunity to plan further ahead in the production process, leading to great costs in rework. The strategic purchasing unit is not always utilised to the extent they could, indicating that employees lack strategic understanding of the importance of the different components. Lastly, the findings show that project managers struggle with making people stick to the periodic plans, which span over 8 weeks. They are much more comfortable with planning in the shorter horizon. All these issue areas indicate that there is a demand for more strategic thinking in the project teams. This need can be related to the changes noted in the beginning of the thesis: as yards outsource more of their production to a wide network of suppliers and as much as 60-80 % of the added value is externally produced, project managers spend much more time upstream in the projects and plan in advance. Ways to ensure that project managers hold the necessary capabilities for thinking strategic was discussed with company representatives. Our findings clearly resonated with the representatives, and we discussed how this could be improved. This discussion will not be elaborated further, as it falls outside of the scope. The findings on strategic planning do not directly violate principles of a viable system. But, it again shows the power of VSM as an analysing tool.

6.5 Limitations of the analysis

A critique that exists against the VSM is that it neglects the qualities brought by the human actors who make up organisations (Flood and Jackson, 1991). It thus says little about the social processes, and how the organisational culture, politics and power struggles influence the organisation. This became evident in our viable systems diagnosis of the Group.

Based on the feedback session with company representatives, we learned how large affect the cultural factors had on the company. The Group is located in a small community where their operations may have large ripple effects. In addition to this, the organisation is influenced by a culture that is typical for small communities, where there often is a sharp social control. This contextual setting seems to influence several of the viability violations we pointed out to the company representatives. The fact that we made this realisation as late as in the feedback session, shows that the VSM might not capture these factors well enough. We argue that by incorporating these factors earlier we could have provided more nuances to the findings in our diagnosis.

How the social context affects the interviews and the feedback session
As elaborated on in the previous section, the social, cultural and political context can be challenging to capture with the VSM. Still, this affects the Group, the people, and thereby also the interviews and the feedback session. This is something we became aware of while we conducted the interviews. During the interviews, we saw how important this context seemed to be for some of the employees work, especially in regards to informal communication and collaboration within the organisation. When we had the feedback session with the company representatives, the importance of the context was also evident. Most of our findings seemed to resonate well, and we had a fruitful discussion with them. They were engaged in discussing the questions, and we did not experience any resistance or unwillingness to answer. As one of the researchers comes from a similar small community on the West-Coast of Norway, we could easily relate to the social challenges brought up by the company representatives, and had interesting discussions on how these challenges are in relation to viability principles. They also agreed on the matter we found to be most sensitive, namely how being family owned can lead to violating the viability principles. It was also pointed out by one of the representatives that change processes can be challenging to implement due to the social and cultural aspect. This underpins the limitations of VSM that we have discussed in the previous section, and supports that further analysis that focuses on the context could add to this work.

Chapter 7

Conclusion

To conclude on the problem statement of this thesis, the main findings of the analysis will first be summarised in light of the theoretical framework applied and the overall problem statement. Next, implications for practice and theory will be discussed and suggestions for further research are outlined. Finally, the limitations of the study is presented.

Main findings

In this thesis, we wanted to explore how the principles of a viable organisation may help yards become more productive and profitable. To do this, the Viable System Model was applied to a shipbuilding company on the West-Coast of Norway. We found several hindrances that violate the principles of viability for the focal company. These have been identified through an empirical case study where interviews were the main input for the analysis, and the VSM was used as a diagnosis tool to identify what hinders viability. The following problem statement guided our study:

How can Norwegian yards become more viable in increasingly complex markets?

To gain insight into this problem area, the viable systems diagnosis was pursued. The aim was to identify if the activities of the focal company were in line with the principles of a viable system. Based on this diagnosis, eight discussion points surfaced:

Discussion point	Diagnosis findings
1	Coordination has a more important role in achieving correct pricing today
2	Transferring of information between tendering and the execution phase is difficult
3	Coordination of meeting activity is abundant
4	Profit seeking subsidiaries reduce the economical viability of the group as a whole
5	There are challenges linked to long term planning and managerial education
6	The organisational structure restricts autonomous operations
7	There is a lack of coordination in strategic project purchases
8	Need for better control of project progress

Table 7.1: Diagnosis findings

Throughout the interviews and a feedback session with company representatives, it became clear that several of the discussion points can be related to the consequences of the fast changes the yard has gone through, by shifting to new and unfamiliar market segments. As an employee stated, several of the daily operations where earlier done ”on autopilot”. During better market times the customers were waiting in line for the focal company to deliver projects, and a limited amount of time was spent on evaluating how projects could be run more effectively and efficiently. This period was a sellers market, where the buying power among shipowners was high, and prices were set accordingly. Decision-making was fast-paced to exploit the opportunities in the market, which in turn reduced the coordination procedures. As the focal company had the wind in their sales during ”the good market”, little time was spent to plan ahead in projects. The yard reaped the opportunities that lied in supplying the offshore market with high quality OSVs instead. It was during this period that Mello et al. (2017) used systems theory to analyse the same focal company, which has proved to be an important basis for our research. The oil crisis that struck in 2014 changed the premise for the focal company and many other yards, and also the premise that Mello et al. (2017) based his analysis on. By balancing the findings of this thesis against what Mello found, it is interesting how the problem areas that surfaced in his study are still relevant, and even have compounded after the market changes. The VSM diagnosis showed that i.e. coordination is still challenging, and we argue that this is more evident in the new market segments. We see that our findings add new insight to the

problems Mello et al. (2017) addressed, as they are highlighted from a slightly different perspective.

The analysis shows that the challenges of the focal company are clearly linked to pricing, coordination of operations and strategic planning. However, by addressing them with principles of a viable system, we argue that this analysis approaches the challenges from a new perspective. The thesis underlines the fact that many of the entangled challenges that companies in engineer-to-order industries are faced with are embedded in a wider system. This is where VSM becomes a powerful tool to view the complex organisation in a more holistic manner. By applying viable systems principles such as autonomy and requisite variety, as well as our deepened understanding of how the systems are interconnected, we drew parallels between all the challenges the focal company is facing, and considered how they deviated from an ideal VSM. To do this, we looked for common denominators between the eight discussion points that surfaced, and eventually identified three ”root problems” in the organisation that are related to principles of viability. Discussion points five, seven and eight do not have a clear link to the root causes, and are therefore not emphasised further. The three overarching issues that deviate from the ideal VSM are:

Viability violation	**Root cause of discussion point**
1: The subsidiaries are profit seeking and have a bargaining relationship that seem to hamper their collaboration in some phases of the shipbuilding process.	4
2: The lack of autonomous operations seems to create the extensive coordination efforts in meeting activity and affects daily decision-making	3, 6
3:The coordination function should be improved to handle necessary information flow	1, 2

Table 7.2: Discovered viability violations

Each of the findings can be assigned as a root cause for the discussion points that surfaced in our diagnosis, outlined in the column to the right in Table 7.2. As the findings in this table seem to hinder the Norwegian yard in becoming more viable, we viewed these three overarching viability violations from different perspectives by discussing them with Robert L. Flood and with the company representatives. This gave us useful insights into how much the company's operating context as well as other cultural and political factors influence the group. These factors actually seem to reduce the consequences of viability violation number one. As our analysis points out, from a VSM perspective, this way of organising the subsidiaries seems to violate the viability principles. However, based on the feedback from company representatives, this is not uncommon in this type of industry. These two views are conflicting, and are overarching for the industry in general.

The focal company is already considering to implement changes that will mitigate viability violation number two. By implementing more ”helicopter management”, the focal company moves towards a portfolio management approach, which could grant more autonomy to the operational units. Throughout the years this has been a difficult trade-off, and this is where our analysis gives new insights from a VSM perspective that can support decision making. Our perception is that there is much to gain from making the units more autonomous, so that decision-making can be done on a lower level, reducing the number of issues brought up to higher management. Granting autonomy could also lead to greater confidence in the decision-making of the units, which today seems to hamper efficient project management. Eventually, this can help the yard become more viable.

Lastly, viability violation number three is addressed. A general insight that has been found to contribute to increasing the viability of the focal company, is the need to emphasise the importance of a strong coordination function. As the projects in the new market segments are not run on ”autopilot” like before, the information flows must be managed more thoroughly to ensure that critical information is forwarded to the correct department at the right time. This will avoid delays due to missing information and enhance the pricing of projects, which in turn increases the economical viability.

As will be elaborated on in this paragraph, all of the three viability violations found at the focal company can be related to the industry in general. In this way, an answer to the overall problem statement is provided. As other shipyards in Norway are also exposed to an environment that imposes great variety, it is argued that there is a lot to be gained for managers to grant more autonomy to the operational units. The same goes for viability violation number three - other yards have gone through similar market changes, putting them at the start of new learning curves, which increases the need for coordination. This is where the viable systems theory emphasises the necessity of a function that coordinates the value-creating processes in a harmonious manner and dampens uncontrolled variety oscillations. Lastly, as profit-seeking subsidiaries are a common way of structuring shipbuilding companies, the VSM perspective on how this hampers information flow and collaboration adds to the discussion on this well-known trade-off.

Practical implications

The practical implication of this thesis is twofold: it contributes to the focal company itself, and the industry in general. As argued in the previous section, applying the theory of viable systems can serve as decision-making support in the already ongoing change processes of the firm. The management of the company can lean on the findings from this thesis when arguing for or against different management styles. Secondly, this thesis can aid other practitioners from the industry, as our step-wise and practical approach to the VSM can be easily related to similar companies. If the findings of this thesis resonate with challenges in other firms, we suggest that managers should also try to view their organisations through the viable systems-lens. For the industry in general, the diagnosis in this thesis adds to the discussion on how to increase the productivity and profitability in the challenging markets. As mentioned in the introduction of this thesis, it takes time to

streamline new value chains in the markets the industry has entered. By applying systems thinking to holistically see how the issues are interconnected in the complex and entangled value chains, they can be managed in a more system-wide and optimal way. In addition to new and challenging market segments, the globalisation and increased level of outsourcing were introductorily argued to add complexity to efficient management of shipbuilding projects. Through this thesis, VSM theory has shown to be a powerful tool for practitioners to break down the complexity of an organisation and provide a proper overview. If practitioners where to investigate further and use this thesis as a guide on how to conduct a VSM, we suggest that they can continue to adopt the System 1 processes identified by Mello et al. (2017), as the empiricism we gathered complied with his perception on what constituted the value-adding processes of a shipbuilding company.

Theoretical implications

An important theoretical contribution of this thesis is to strengthen the viable systems theory reputation as a powerful tool for explaining a complex and entangled organisation. Throughout this thesis, the VSM theory has heavily guided the steps of the analysis. VSM helped us visualise the complex organisation with the principles of a viable system as our basis. This clarified what the underlying issues of the focal company were and shows the practical applicability of VSM as an analysis tool. To the best of our knowledge, the VSM has not been applied at any European shipyards before. Hence, this thesis may assist other researchers and practitioners when applying VSM on shipyards or other organisations that operate in similar industries, such as construction. Additionally, this thesis was written while having close dialogue with, and guidance from, two company representatives. We argue that there is new insight to gain for the world of VSM from our practical approach to applying principles of viability to this industry. The feedback from the representatives of the focal company provides useful insights into the applicability of the VSM. The feedback adds value as it shows how, even when used in a modern era, the generic model that Stafford Beer came up with in the 1960s is still highly relevant for dealing with these complex and rapidly changing organisations.

Further research and limitations

The findings and the feedback from company representatives provided a basis for further research. Much of the feedback was related to the culture of an organisation located in a small community, where decisions may have large ripple effects. This contextual setting of the focal company turned out to largely influence several of the viability deviations pointed out to the company representatives. As one of the managers phrased it:

> ”We have less tools in our managerial toolbox because of our important position in the surrounding environment.”

According to this manager, there will always be difficult trade-offs on how the company is run. But one concept was emphasised as a measure that can help address several of the issues brought up for discussion: change management. This is an important tool that can be challenging to apply for managers in a company where the culture has strong roots in the history and the local community they operate in. It would be interesting to compare these strong environmental factors against applicability of viability principles, and research how

the VSM can facilitate change management in the focal company.

The next step in our analysis of the focal company would be to gather more empirical data on how the local community context truly affects the organisation, and consider these findings from a VSM perspective. This will give more insight in to how the meeting activities in the focal company might be reduced. Also, it might provide an understanding of how the profit seeking subsidiaries, that often end up in bargaining situations, still manage to communicate and collaborate with each other in practice. It would be interesting to address this bargaining relationship on a deeper level by applying VSM analysis. This could help us to better understand how the viability principle can be so contradicting with the view of the company representatives.

Further, it is suggested to apply VSM tools to develop a suggestion for restructuring the organisation. VSM has only been applied for analysing and diagnosing purposes, but the VSM can also be useful in suggesting practical reorganisation of the company. It would then focus on mitigating the hindrances to viability that the focal company is facing today. It is necessary to continue the conversation with the company, and present our findings to the company owners to see if it resonates with them. Only then would it be possible to work out a plan for taking action and implementing changes, and thereby altering some of their processes to increase viability.

It would also be interesting to see the how technology and digitalisation can be applied to improve the coordination challenges the VSM has revealed in this analysis. It is already discussed with company representatives how IT-platforms can be better exploited to reduce the meeting activity, and agreed that change management is an important tool to enhance this. The feedback supports to further investigate this finding, as many of the interviewees responded in a positive way to our suggestion on giving all of the organisational functions insight into a common IT-platform in an effort to enhance coordination.

In this analysis, the scope is limited to only consider one level of recursion. This confines our thesis, as it is only analysed how this level is linked to the levels above or below. This makes it difficult to fully grasp the entire perspective of the context the focal company operates in. Further research can reveal how events in these different levels of recursion could affect the hindrances to viability for Norwegian yards. Finally it is recommended that this thesis is used as a starting point for any company willing to apply VSM.

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Appendix I

Interview guide

Background and your work:
1. What is your title/position and which department do you work in? How long have you been here?
2. Have you previously worked in other departments? (the Yard or the Design Department?)
3. Can you describe a normal day at work?
a. What are your areas of responsibility?

Communication and information flow
4. Who do you cooperate and communicate the most with during your working day? (In which department do these people work?)
a. How is the possibility to communicate with these people?
b. Which tools do you use to communicate?

5. Which information do you typically need to have available to be able to do your job?
a. How available is this information?

6. Do you have any regular meetings? During the day, week, month and so on.
a. Do you think there is too much, too little or a good amount of meetings?

7. Do you know what is communicated from the Design Department and the Yard to the R&D department? How often?
8. What is communicated to the management of the Group? How often?
9. If you have leadership responsibility:
a. How do you follow up your employees?
b. How do you become aware of problems related to your area of work?
c. How do you inform your employees about worries and challenges
that fall within your area of responsibility?

10. How is the culture for sharing bad news in the Group?

S1 - Operations
This question applies to all the core business/operations of the Group, which we have defined as: tendering, engineering, procurement, production, commissioning:
11. Which of these operations do you take part in?
a. How is the cooperation between the Yard and the Design Department in each of these operations?
b. During these operations, which people in the Yard and the Design Department do you have the most contact with, and have you experienced any challenges in this cooperation? How is it coordinated?

12. Are you working in teams throughout these processes? How is the cooperation within the team?

S2 - Coordination:
13. Which coordination methods do you consider to be the most important throughout a project?
14. Do you ever experience too much coordination between the processes, or too little? Both in your day to day work, and more long term.
a. Is this difficult to communicate?

S3 og S3* - Control and audit and resource bargaining
15. Is someone controlling the work you do? In this case, who and how?
16. What responsibilities does the project controllers have?
17. Can you tell us about the QMS process in the Group?
18. What is included in the reporting calendar?
19. Who uses the new Dynamics ERP and CRM systems? What are your opinions about these?
20. Do you have any specific goals in your work? Do you i.e. have any performance indicators?
a. How are these set?
b. How often are they measured?
c. Do you have budget reviews? How often?

21. What do you consider to be the biggest resource restrictions for the projects run at the yard?
a. How is this handled?

22. Do you make any changes from project to project when it comes to resources?

S4 - Intelligence
23. How is the Group's communication with suppliers, customers and other external stakeholders managed? (i.e banks, class societies etc)
a. Is it clear to you what needs and challenges these external have that you can help them with?
b. What do you do to meet these challenges?
c. Does the Group have any systems to react fast to market changes?
d. How do you become aware of the needs in the market?

24. Can you tell us more about the price model you have developed?
a. How much do you cooperate with the project controllers?
b. Can the R&D Department contribute to a more continuous evaluation of the pricing?
c. How accurate is it?
d. Is it trusted in the Group?

S5 - Policy

25.To what extent is the board of the Group involved in the daily activities?
26. Do you engage in strategic decisions?
27. How do you describe the overall goal of your department?

To end

28. What do you think is the biggest strengths and challenges of the Group today?
29. Is there something more you want to add?

Appendix II

Empiricism coding

Sorting code	SDI code	Interview	Comment
S1 - Operations	A normal working day	When you are a sales manager, your day depends a bit which phone call you get in the morning. Normally we travel a lot and visit customers, but that is difficult in these days. The day can entail anything from working on a sales project, depending on where we are in the project, the work is very different. In some projects we are just discussing with the customer over the phone, while in others, we have full project teams that are working with calculations. For me it is important to stay updated and understand what is going on, and who is doing what.	Can be useful in chapter 5
Information flows	Communication tools between functions and the environment	Normally we sit in neighbouring offices, so that is not a problem. But the way that the situation is now, we have used Microsoft Teams quite a lot, which works very well. We also use share-point. We have all the tools that Microsoft deliver, and we use these quite regularly. We also spent last year on developing the CRM system. That makes it easier to have an overview of all the information that goes out to our customers at any time.	Relevant to issue 1
S2 - Coordination	Meeting activity	We do not have it on a daily basis, not the sales department at least, we have it once a week. The way the market situation is now, there are too few projects for us to discuss them every week. But yes, we do have regular meetings. And of course, if we are in the end of a project phase, we have daily meetings. Then we sit in teams and work through numbers and discuss ideas all the time.	
S4 - Intelligence	Information flow between S1 and S4	We have a close dialogue with IN because of their special price model. We see that it can both hit and miss completely in different projects, and therefore we have a close dialogue, especially our Bid-manager has a close dialogue because they are trying to calibrate the tool. Based on the cost elements we see that they might not have included.	Talks about the pricing model
S5 - Policy	The boards participation in the operations	They are very hands-on, because most of the board is made up by owners and employee-representatives from the company. Two of the family owners are very active in the Group. And of course, some of the other siblings are not that involved on a detailed level, but they are still very involved. So in that sense we are very much a family ran company	

Appendix III

Empiricism visualisation