



Master's degree thesis

LOG950 Logistics

Collaboration practices in supplying standard parts for the shipbuilding industry - a case study of Brødrene Dahl Vietnam

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Preface

This thesis represents the results of a two-year Msc program in Logistics at Molde University College. By accomplishing this study, the author has obtained significant amount of knowledge regarding collaboration practices between partners in a supply chain. Additionally, valuable insights into the shipbuilding industry, both in South East Asia and in general, have also been gained. As the topic of interest can be considered broad, it is undeniable that the author had faced a number of challenges throughout the process of conducting the study. Nevertheless, the author had also received help from various individuals as well as organizations, without which it will be impossible for the study to be completed. Thus, the following words are dedicated to express the author's gratitude toward the received helps during the time conducting this study.

First of all, the author would like to give the biggest thank to her supervisor, Associate Professor Per Engelseth, for all of his supports, feedbacks, guidances and suggestions during the process of doing this thesis. It is certain that without such supports, it would be very challenging for the author to complete the study. All of the supervisor's comments and suggestions had contributed significantly in the final outcomes of the thesis.

Second of all, the author also would like to express her gratitude toward the cooperation from all of the participating informants, especially Mr. Tor-Erik Sivertsen from Brødrene Dahl Vietnam. His helpfulness in providing information as well as setting up necessary contacts is the major contribution lead to the completion of this study. Additionally, the author would also like to thank all the other informants, including Mr. Rune Misund from Brødrene Dahl Maritime, Mr. Håvald Vollen from VARD Vungtau, Mr. Patrick Slagmolen from DAMEN Songcam, Ms. Hien Vu from Brødrene Dahl Vietnam, and Ms. Linda Wang from the Saint Gobain China Sourcing Office.

In the end, the author would like to express the gratitude towards friends and family members who have provided the greatest supports and motivations for the completion of this thesis. A big thank is dedicated to Helge Hellevang, who proof-read and suggested valuable improvements of thesis. A thank is also sent out to Ha Quang Minh, a fellow student who have helped the author during the data collection process. Finally, big thanks to Mariami Suarishvili and Noelia Deira for their great supports throughout the entire time of conducting the study.

Summary

This thesis aims to investigate the collaboration practices being applied in supplying standard parts for the shipbuilding industry. The research was conducted as a multiple cases study of Brødrene Dahl Vietnam, a retailer for pipes and valves for different shipyards in South East Asia, and its business network. To approach the topic of interest, a research question was proposed: *What characterizes the supply chain collaboration at the case company (Brødrene Dahl Vietnam)?*

To answer this question, an extensive multiple cases study was conducted. The cases cover a range of both suppliers and customers relationship, each of which is considered a unit of analysis. Based on the initial information obtained from the case company and a preliminary literature review, the study approached the issue of collaboration via three aspects: information exchange, vendor-managed inventory, and engineer-to-order supply chain, together with its coordination practices. These concepts were further cooperated into a framework, which formed the collaboration patterns of the different business relationships at the case company.

Findings from the study revealed a number of collaboration practices both at strategic and operational level. At strategic level, collaboration practices at the case company were characterized by the strong efforts in combining resources accessed via different business relationship. The combination of resources were shown through BD Vietnam's utilization of BD Group's technical and management resources as well as their usage of the Saint Gobain China Sourcing Office in managing the local suppliers in Asia. At practical level, collaboration practices at BD Vietnam were strongly characterized by broad but selective information sharing, using simple methods, between BD Vietnam and its partners. Additionally, the application of vendor-managed inventory with VARD and potentially another customer were also considered a strong characteristic of BD Vietnam's collaboration practice at operational level.

Based on these findings, two possible theories were generated. Firstly, the study suggested the possibility of applying vendor-managed inventory in engineer-to-order supply chain. This is considered an interesting issue, as vendor-managed inventory is usually common in make-to-stock supply chain. Secondly, the study suggested the possibility of an engineer-to-order supply chain to function without an intergrated information system. It should be noted, however, that these theories were generated from study of a single supply chain. Thus, it was suggested that further studies with larger sample sizes needed to be carried out, in order for retest the findings and theories.

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Introduction

1. Research background

The shipbuilding industry is characterized as a one-of-a-kind production industry (Dugnas & Oterhals 2008). Accordingly, the end products in this industry are engineered to order, and even though series of vessels occur, differences in each vessel within a series should be expected. Each vessel is different to the last, due to the specific requirements from each customer (ship owners). Clearly, this characteristic suggests that shipbuilding companies will always operate in an engineer-to-order supply chain, in which production dimensions are completely customized. However, it should be noted that a ship is composed of not only engineer-to-order parts, but also a certain amount of standard parts. As these standard items can be used in multiple products, a question is raised upon the supplying process of the items. Additionally, if there is more than one tier from the manufacturers of these items to the ship building companies, how are the items forecasted, planned, produced and distributed? This is an interesting issue concerning the crossing of engineer-to-order and make-to-stock/make-to-order supply chain.

In order to find the answers to the aforementioned issues, a research with multiple case studies concerning the collaborative supply chain strategies at Brødrene Dahl Vietnam (BD Vietnam), a pipes and valves retailer for the shipbuilding industry, is conducted in this paper. The goal of the paper is to apply different theories of collaborative supply chain management in analyzing the strategies being applied to manage the supply flow at the company. Ultimately, the paper also aims at finding a common collaborative strategy or group of strategies that BD Vietnam is applying for its supply chain management practices.

To reach the goals of the paper, different types of relationships that BD Vietnam has with its key stakeholders were the focused units of analyses. First of all, the investigations aimed to cover BD Vietnam's relationship with its main supplier, which is BD Maritime Operations in Ålesund (BD Norway), Norway. An analysis of supplier management practice between BD Vietnam and its local suppliers in China was also included in the paper. Additionally, the research also investigated BD Vietnam's relationship with its customers, including the long time partner VARD, the newly acquired Japanese customer Niigata Shipyard (Niigata), and the potential customer Damen Group in Vietnam.

In terms of supplier relationships, BD Vietnam has a strong relationship with its main supplier BD Ålesund. It was informed that although this main supplier administers supplies

from Norway, many of the goods might be transported from other countries, especially China. These suppliers are managed by a third party company which also owns the BD Group. This triangle of supplier relationship indicates high level of supplier coordination and management, especially in the ship building industry where flexibility is to be expected. Thus, one of the goals in this paper was to investigate the supplier coordination practices at BD Vietnam, in an attempt to understand how the company can organize and manage its suppliers.

In terms of customer relationships, VARD's shipyard in Vungtau is currently BD Vietnam's biggest customer, who counts for about 55% of BD Vietnam's turnover in 2015. The relationship between VARD and BD Vietnam is characterized with high level of trust and close collaboration. This relationship was built throughout the years, with the involvement of not only the two companies, but also the two groups. Thus, it encompasses details that call out for investigations. The questions to be asked concerns the collaborative practices in this relationship, as well as whether the BD Vietnam-VARD relationship model can be applied for BD Vietnam's other customers.

In recent years, two other relationships stood out among all business relationships that BD Vietnam has with its customers. The first customer to be investigated is Niigata Shipyard. Niigata is the new Japanese customer that started working with BD Vietnam in 2014. Despite the short history, sales to this customer added up to a significant amount of the total sales at BD Vietnam in 2014 and 2015. The second and last customer to be investigated in this paper was DAMEN Songcam. It was informed by BD Vietnam that the two companies have some history in collaboration together, however it really started picking up 2,5 years ago when DAMEN started building its yard in Vietnam. As DAMEN also has several partnership shipyards, it appears that the potential is high for this customer, which explains why BD Vietnam is now looking at this customer as the potentially next big customer after VARD. It can be seen that these two aforementioned customers provide interesting issues to study, regarding the question of how BD Vietnam approached and collaborative with them, and if any of these collaborative tactics were learnt and reapplied from the collaboration with VARD. Finding the answers to these issues was one of the study's main goals.

All of the above mentioned relationships were investigated under the lens of a number of theories. These theories center around supply chain collaborative strategies, with a strong focus on Vendor Managed Inventory. The decision to focus on Vendor Managed Inventory theories is due to the current application in the relationship between VARD and BD Vietnam. Resources combination was one of the approaches used in analyzing the

collaboration practices in BD Vietnam. Characteristics of engineer to order supply chain were also important issues to discuss, together with the issues of communication and information system in supply chain management. The application of these theories in studying the case study lead to the formation of the conceptual framework as below:

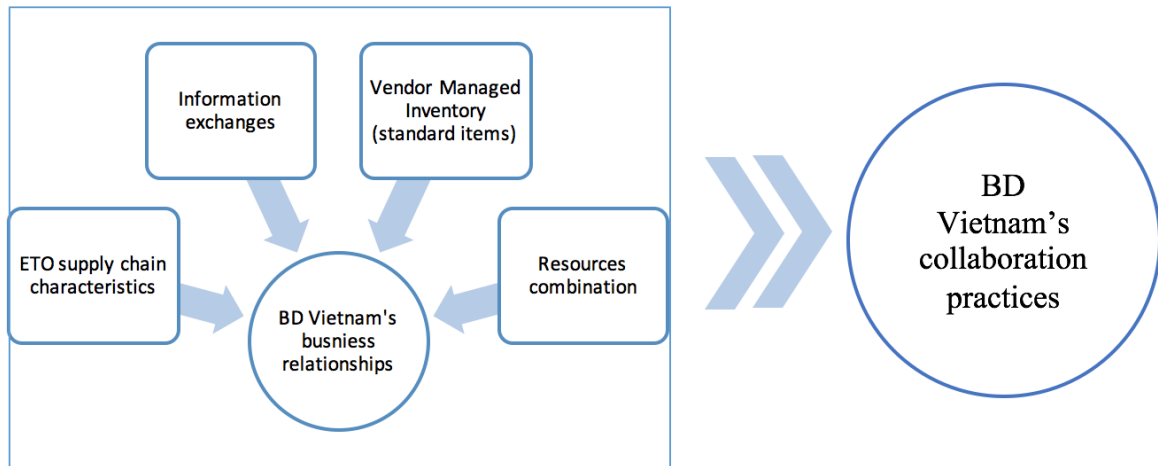
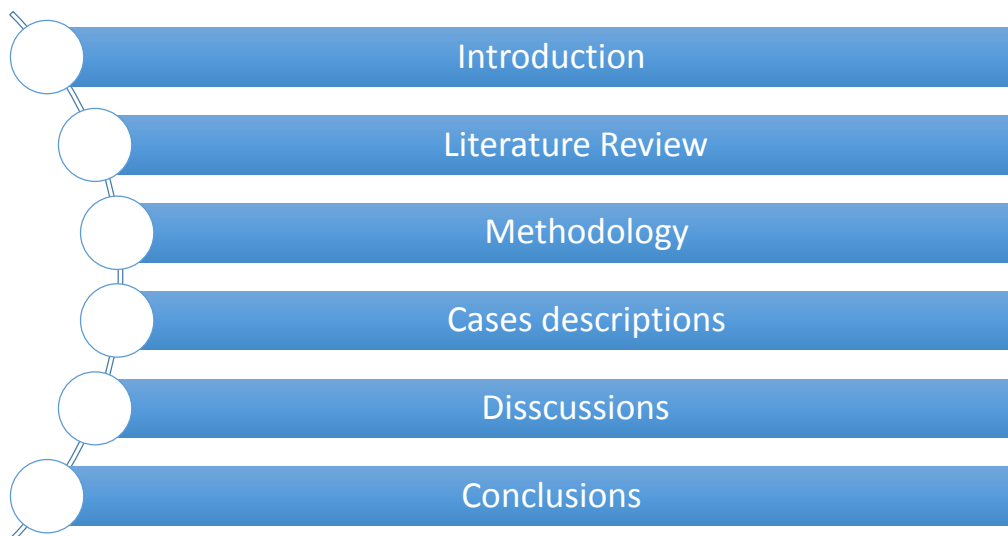


Figure 1. The conceptual framework.

2. Structure

The thesis consists of five chapters, with details as followed:



Literature review

Collaborative supply chain has been the focus of research in a large number of studies. It is defined as a system with two or more companies working jointly to plan and execute supply chain operations, which lead to greater success than when acting isolated (Simatupang & Sridharan, 2002). It has been stated that the application of this system helps creating a seamless and synchronized supply chain, thus enabling companies to gain significant competitive advantages in the market, such as reducing inventory costs and increasing responsiveness (Holweg et al., 2005). A close relationship also allows partnering organizations to increase inventory turnover, enhance revenues as well as increasing the flexibility in dealing with uncertainties in supplies and demands (Bowersox, 1990; Lee et al, 1997.as cited in Simatupang & Sridharan (2004)).

There are a number of different approaches toward collaborative strategies in supply chain management. However, the core issues that prompt companies to take part in a collaborative supply chain can be argued as: benefits of a shared information system, the supply chain characteristics, and suitable partnership strategies. Studies have shown that information breakage is one of the main reasons for poor supply chain performance (Lee et al., 1997; Lee & Whang, 2000). Thus, it has been stated that even though collaboration in the supply chain comes in various forms, the common goal is always to create a transparent demand pattern that is visible throughout the entire supply chain (Holweg et al., 2005). In order to deal with demand uncertainties, a number of collaborative supply chain strategies have been introduced and discussed; such as Continuous Replenishment (CR), Vendor Managed Inventory (VMI) or Collaborative Planning, Forecasting and Replenishing (CPFR). The strategies have received considerable attention from researchers, and they have been widely applied in different industries. On the other hand, the suitability of certain collaborative supply chain strategies significantly depends on the characteristics of the end products, the different operational processes, and the level of customer's involvement in the production of end items, etc. These issues fall into the category of supply chain characteristics, thus it is suggested that different supply chain characteristics also plays an important role in the success of certain collaborative supply chain strategies.

Based on the above arguments, this paper will review scientific works concerning the three issues of collaborative supply chain management, with a special focus on certain types of concept, based on the information obtained from the case company. The first part of the literature review addresses the concepts of information system with a focus on the communication system in a supply chain. The second part reviews issues related to Vendor

Managed Inventory, one of the collaborative strategies and also the applied strategy at the case company. The final part discusses the definitions as well as characteristics of engineer-to-order supply chain, which is the main supply chain environment that the case company is operating in. In the end, summaries of the literature review are used in the discussion part of the paper, in order to argue for the suitability of collaborative strategies that have been applied at the case company.

1. Information sharing in supply chain management

As organizations are open systems that constantly interact with their environment, it is logical that the need for information is significant and that it reflects this nature of organizations. According to Boddy, Boonstra and Kennedy (2008), companies or organizations draw resources from the external environment (inputs), transform them into outputs and pass them back to the environment. Information about inputs could include the cost and availability of materials, delivery quantity and schedules; sales data, etc. Output information can be customer satisfaction, service level, goods or services, etc. Within companies, managers depend on a flow of accurate and timely information in order to make internal processes efficient, integrate different functions within the business, and create electronic links with customers. In a supply chain perspective, it is undeniable that the needs for information remain significant, if not amplified. Information, particularly the transparency and quality of information flows play a crucial role in ensuring the effectiveness of supply chain activities. Good information sharing program and strategies can help reducing information asymmetry in the supply chain, and consequently help avoiding opportunistic behaviors and sub-optimal decisions (Simatupang & Sridharan, 2002).

According to Lee and Whang (2000), the integration and optimization of three flows in the supply chain, which are materials, information and financial, form the core concern of supply chain management. It suggests the extensive coordination both internal and external of a business unit, in order to plan, produce and deliver a product to the end customers. Advanced information technology has enabled such coordination to be more and more effective. Due to the development of the technology, particularly in information sharing, companies nowadays can work in tight coordination in order to optimize the chain-wide performance, with results that are beneficial for all partners (Lee & Whang, 2000).

As the aim of this paper is to describe different types of collaboration between the focal company and its customers, it is clear that information sharing must have certain impacts on the different relationships, thus the concept directly relates to the content of the paper.

1.1. Information quality

According to Petersen (1999, as cited in Zhou & Benton, 2007), information quality refers to the degree with which the information shared by one partner meets the needs of the other partners. Zhou and Benton (2007) listed a number of researches that concern the issue, consequently discussing a number of characteristics of information quality. Accordingly, Neumann and Segev (1997) stated that information quality refers to content, accuracy, regency and frequency of information; McCormack (1998) measured information by accuracy, frequency, credibility, and availability of forecast; Petersen (1999) measured information quality by currency, accuracy, and completeness; and McGowan (1998) argued that the information system is perceived useful when the information is high quality, readily accessible, accurate and relevant. This approach was also supported and further developed by Forslund (2007), who conceptualized information quality in terms of accuracy, convenience of access and reliability.

In 2006, Li and Lin conducted a paper studying the impact of environmental uncertainty, intra-organizational facilitators, and inter-organizational relationships on information sharing and information quality in supply chain management using data collected from 196 organizations. Results from the paper suggest that trust and shared vision among partners have a strong influence on the quality of shared information, however supplier uncertainty appears to have an insignificant impact on information quality. Additionally, the authors also stated that top management has a strong impact on information sharing but has no impact on information quality. Finally, results from this study also indicated that information sharing and information quality are not impacted by customer uncertainty, technology uncertainty, commitment of supply chain partners, and IT enablers (Li & Lin, 2006).

Researches have also been conducted studying the impact of information quality to supply chain activities. Gosain et al. (2004), in a study concerning the flexibility in e-business supply chain, suggested that sharing a broad range of information to partners is not beneficial for the supply chain flexibility, and organizations should instead focus on improving the quality of shared information. According to the authors, supply chains invest on enhancing the quality of shared information gain significant improvement in operational performance, especially in terms of flexibility. Rossin (2007) studied the impact of information quality on

supply chain responsiveness and confirmed that for a responsive supply chain producing innovation products, poor information quality results in an increase in total costs and a decrease in customer service measured in units missed and orders delayed. In 2005, Malhotra et al. conducted a study accessing the mediating role of information quality between knowledge creation, information sharing and operational efficiency. Results from the study suggested that companies involve in the collaborative supply chain partnerships, which are characterized by a broad range of high quality strategic information exchanged, have the potential to achieve high operational efficiency and knowledge creation.

1.2. Information content

Zhou and Benton (2007) criticized the fact that many managers, concerning information sharing, focus only on the technology behind the act, i.e. the software and hardware that enable the sharing of information. Schroeder and Flynn (2001, as cited in Zhou & Benton, 2007) suggested that it is the way companies use the information that lead to differences in performances. This study indicated that investing in information technology alone is not enough, and only when managers pay equal attention to both technology investment as well as the process of choosing the right information to share and putting the information into use, can a company achieve effective performance.

Information content can include data such as supplier information, manufacturer information, customer information, distribution information, and retailer information (Handfield and Nichols, 1999; Chopra and Meindl, 2001, as cited in Zhou & Benton, 2007). It can also refer to different specific types of information such as sales data, available materials, production plans, etc. In the context of this paper, several types of shared information that were mentioned in Lee and Whang (2000)'s paper will be referred to as information content and be applied in the discussion part, in order to understand the current situation of shared information between the case company and its partners. These types of shared information include: inventory level, sales data, order status for tracking/tracing, and production status/delivery schedules.

- Inventory level

Lee and Whang (2000) stated that this is the most commonly shared information among supply chain partners. Researches regarding this type of information have confirmed that accessing inventory status can contribute in lowering the inventory level in the supply chain. A simple example can be taken from a two level supply chain where a retailer purchases products from a manufacturer. Should the inventory be managed independently and no

inventory information are shared between the two partners, it can lead to the duplicate situation where both partners are overstock or out of stock. Nevertheless, with the open access to inventory status for both partners, the upstream company can keep track of the inventory level at downstream partner, thus decide to produce only when the inventory at the downstream partner is low enough. This collaboration can help manufacturers to better decide what and when to produce, at the same time allow retailer to improve their service level with less inventory.

Sharing of inventory status can be implemented in different forms, such as CR or VMI. It should also be noted that in practice, most of these programs are implemented based on the principle that the buyers share inventory information to the suppliers and allow the suppliers to manage their inventory with a guideline (Lee & Whang, 2000).

- Sales data

In a traditional transactional relationship, information is communicated via orders. Nevertheless, Lee et al. (1997), in a study of the “bullwhip effect”, suggested that order data often distorts the true dynamics of the market, as they are the results of various information and decisions made by the buyers. Thus, information transferred in the form of orders can misguide upstream suppliers in their inventory and production decisions. Lee and Whang (2000) suggested that the variance of sales data is often smaller than that of orders data. Sales orders from retailers enable the suppliers to better prepare for the volatility of the market. It also allows suppliers to have a better understanding of the market through avoiding the downstream partners’ initiated information such as promotion or discounted programs, which can lead to erratic orders patterns. In general, access to sales orders put suppliers in a better position to pinpoint real demands from other misleading information.

- Order status for tracking/tracing

One of the key benefits of shared information is the improvement in customer service quality, as it allows customers to automatically track and trace orders status without having to rely on a retailer. Additionally, it leads to the reduction in payment cycle due to the potential in improving delivery time, and saving in labor costs and manual operations through automated answering service.

- Production/Delivery schedules

A company can make use of its suppliers’ delivery or production schedules in order to improve its own schedules (Lee & Whang, 2000). Information regarding job status, job availability from suppliers can help buyers to expand their production horizons, consequently allow them to provide more accurate due dates for their customers. Similarly,

information about production or delivery schedules at the retailers can assure manufacturers with reliable resupply and allow them to better plan the resupply point.

1.3. Electronic Data Interchange (EDI) and the supply chain communication system

1.3.1. The supply chain communication system

Information technology plays an important role in enabling the collaboration practices between organizations (Pramarati, 2007). Information technology in supply chain management can be found in various forms, however in the context of this study, the focus will be solely on supply chain communication system, which is one subset of supply chain management system. The system, according to Bowersox, Closs and Stank (1999, as cited in Wu et al., 2006), is defined as an information system shared by partners in a supply chain in order to facilitate electronic transactions, quality and cost calibration, and collaborative forecasting and planning. Communication systems are designed to overcome barriers of time and distance (Boddy et al., 2008). The supply chain communication system can include a number of communication methods, ranging from traditional channels such as face-to-face meetings, telephone, emails or informal business meetings, to methods that involves electronic interface systems such as EDI, to link different parts of the supply chain management together including enterprise resource planning, customer relationship management, advanced planning, transportation management, and warehouse management systems (Wu et al., 2006; Nakayama, 2003). In addition to EDI, Radio Frequency Identification (RFID) is the newly emerged communication technology that is expected to revolutionize many of the supply chain operations, especially if the scope of implementation is extended from internal warehouse and distribution processes to supply-chain processes involving collaborating partners (Prater *et al.*, 2005, as cited in Wu et al., 2006).

1.3.2. EDI

1.3.2.1. Definition and relational benefits in adopting EDI

According to Lee and Whang (2000), EDI was originally designed to be a means to process transaction, however it has been extended to facilitate sharing of some other information such as point of sales or inventory status. EDI is a crucial element for the success of various collaboration strategies such as VMI, CR, CRP, etc.

Swatman and Swatman (1992.as cited in Iacovou, Benbasat & Dexter, 1995) defined EDIs as cooperate inter-organizational systems that allow trading partners to exchange structured business information electronically between separate computer applications. Pfeiffer (1992.as cited in Iacovou et al., 1995) suggested four conditions that an inter-organizational system needs to fulfill, in order to be classified as EDI. The conditions are:

- It must have at least two organizations in a business relationship as users;
- Data processing tasks pertaining to transaction at both (all) organizations must be supported by independent application systems;
- The integrity of data exchange between application systems of trading partners must be guaranteed by agreements concerning data coding and formatting; and
- Data exchange between the application systems must be accomplished via telecommunication links

EDIs act as the agents that enable information flow between or among trading partners, thus it is unavoidable that it can bring certain benefits to one or more organizations in the relationship. Bensaou (1997), in a study concerning the role of information technology on buyers-suppliers relationship in Japan and the United State, suggested that in the manufacturing sector, the use of EDI applications across multiple functions (such as design, purchasing, production control, delivery or payment) provides greater information processing capabilities that support greater cooperation among partners. A similar finding for the Australian automaker industry was also found by Mackay (1993.as cited in Nakayama, 2003). Stump and Sriram (1997.as cited in Nakayama, 2003) also suggested that the percentage of IT usage in transaction increases the overall closeness in buyers-supplier relationship.

1.3.2.2. EDI drawbacks and its adoption enablers

Regardless of the above mentioned benefits of EDI, this invention also has a number of drawbacks. Some of these drawbacks, which are discussed by Lee and Whang (2000), can be listed as below:

- Since EDI is designed as for all companies in one-fits-all spirit, it may not meet the exact needs of a supply chain;
- EDI is designed primarily for transaction processing, especially around purchase orders and invoices, thus it has severe limitation for information sharing;
- Small and medium sized companies are often discouraged by the high costs of installing EDI.

The drawback regarding high costs of installing EDI in organization was also mentioned in Iacovou et al.'s study (1995). The authors considered financial resource as one of the two organizational enablers that can facilitate the adoption of EDI in organizations. The financial readiness refers to financial resources available to pay for EDI installation, implementation and ongoing expenses during usage. Although the cost of adoption is not high, the integration process can cost a company over 10000 USD (Bouchard, 1993.as cited in Iacovou, 1995). Based on this argument, the authors stated that small companies tend to lack such resources, thus limiting their ability to receive all strategic benefits of the technology. This issue certainly acts as a barrier toward the adoption of EDI in small companies.

Technological readiness is another factor that can decide the organization's preparedness in adopting EDI. Technological readiness refers to the level of sophistication of IT usage and IT management in an organization. Companies with high level of technological resources are less likely to be intimidated by the technology, have access to IT facilities such as hardware, software, IT experts, etc, and possess superior cooperate view of data as an integral part of overall information management. Clearly, this factor plays an important part in utilizing the power of EDI and enabling organizations to optimally integrate EDI in their systems, in order to receive all of the expected benefits.

Another EDI enabler to be mentioned is external pressure, particularly competitive pressure. Competitive pressure refers to the level of EDI adoption in the industry that the organization is a part of. Accordingly, companies will be more inclined to adopt EDI if more trading partners, and their competitors, become EDI-capable (Iacovou, 1995).

2. Vendor-managed inventory

Collaboration has always been one of the most discussed issues in supply chain literature, among which a large number of collaboration strategies have been presented and analyzed. In this paper, one specific collaboration strategy, which is vendor managed inventory (VMI), is chosen to be applied for one relationship the company has with a long term customer. Analyzing the success of applying this strategy at the case company is one of the goals of the paper. Therefore, it is important that literature regarding this concept is properly presented.

The following part of the paper reviews the concept of VMI collaboration or relationship in supply chain management. All of the discussed theories, including the VMI definition, VMI successful criteria, as well as its benefits will be used to describe the existing relationship in one of the cases in the paper. Additionally, these theories will also be used to discuss the potential of VMI implementation in one other case. These discussions will be the response to the first, second and fourth research question in this thesis.

2.1. Definitions and types of vendor-managed inventory (VMI) collaboration

2.1.1. Challenges in supply chain inventory management and VMI

Inventory management is one of the most important issues in the entire supply chain management. Various studies have been carried out in order to provide companies the most optimal methods to control their inventory so that inventory costs can be kept at the lowest level possible while providing the best service to their upstream customers. A number of these concepts and models can be named such as the re-order point, economic order quantity (EOQ), or economic batch quantity (EBQ), etc. These sophisticated models are needed to enable accurate and timely planning and control of logistics in a focal firm (Harrison & van Hoek, 2008). Nevertheless, a company cannot stand alone in the market, and usually is at the center of many possible connections with other suppliers and customers companies. This position put the focal firm in a difficult situation, as upstream process such as distribution and retail for both finished products and spare parts are subject to independent, random demand, which can increase the fluctuation of demand and consequently making detailed inventory planning a big challenge. When it comes to coordinating logistics among supply partners, one big consequence that can be generated from poor coordination is amplification of changes in demand upstream, which are often referred to in scientific studies as the bullwhip effect (Lee et. Al, 1997; Seung-Kuk & Bagchi, 2007; Carlsson & Fullér, 2001). The bullwhip effect occurs when the demand order variability in the supply chain are

amplified as they moved up the supply chain, and it is the result of rational decision making by members in the supply chain. In a supply chain for a typical consumer product, even when consumer sales do not seem to vary much, there is pronounced variability in the retailers' orders to the wholesalers. Orders to the manufacturer and to the manufacturer's suppliers spike even more (Lee et al., 1997). This has the unfortunate impact of increasing manufacturing costs at the suppliers, because they are asked to make large quantities at irregular time intervals (Harrison & van Hoek, 2008).

To overcome this challenge, a number of coordinating programs have been studied and introduced to companies, such as Efficient Consumer Response (ECR), Continuous Replenishment (CR) or Vendor Managed Inventory (VMI). These programs or methods, are all focus on increasing the information visibility throughout the supply chain, thus enable the accurate planning and better coordination at all levels of the supply chain. In this study, Vendor Managed Inventory will be the focused subject.

Various literature studies define VMI as an approach to inventory and order fulfillment whereby the supplier, not the customer, is responsible for managing and replenishing inventory (Harrison & van Hoek, 2008; Elvander, 2006; Pohlen & Goldsby, 2003; De Toni & Zamolo, 2005). This is said to be the practice to counter the traditional pull scheduling, in which orders quantity and delivery time are mainly decided by the retailers. Under VMI, the manufacturers decide how many and when to send the next order. In another word, the suppliers assume responsibility for monitoring sales and inventory, and uses this information to trigger replenishment orders. In practice, the basis on which decisions will be made is agreed with the retailer beforehand, and it is based on the retailer's sales information.

According to Vigtil (2008), VMI or VMI relationships have received significant attention among researchers, thus are being referred to by different names. There have been numerous discussions regarding the similarity and differences among different inventory coordinating methods, some of which consider these methods the same concept, only with different names. When defining a collaboration program based on VMI concept, some authors suggest a difference in the level of integration based on the time taken to transfer ownership of the goods. There are practices where the ownership of the goods is transferred to the customers upon dispatch or on arrival at customer's warehouse, and the supplier is only responsible for the replenishment process. In more integrated practice, ownership of the goods remains with the supplier until stock withdrawal, which means that the goods are in the custody of the customer while still owned by the supplier. Mattson (2002, as cited in Vigtil, 2007) suggested that the first situation should be referred to as Vendor Managed Replenishment (VMR),

while the second practice can be considered true VMI. On this issue, Pohlen and Goldsby (2003, as cited in Vigtil, 2007) argued that the difference between these two levels of integration lies in who has the interest in keeping inventory volumes down.

Vigtil (2008) commented that when identifying a VMI relationship, one cannot rely solely on the name. Accordingly, the author argued that one might encounter “VMI relationships” that are not true VMI because some specified criteria are missing. On the other hand, by dismissing collaboration programs that do not have “VMI” or the like in the name, one is likely to miss out on many true VMI relationships. Essential criteria of a VMI relationship, according to this study, include:

1. *The replenishment decision is in the hands of the supplier*, both with respect to frequency, volume and time.
2. *Supplier’s replenishment freedom is limited to preset performance standards*; these could be max/min inventory levels, reorder point agreements, inventory turnover measures, required service levels and others.
3. *Some sort of demand information is transferred from the customer to the supplier*; frequency and format of information exchange may differ, as do type of demand information.
4. *There are no customer orders initiating a purchase*; stock withdrawals are made by customer on demand and related invoice is issued periodically or by activity.
5. *The receiving warehouse is owned by the customer or operated by some 3rd party on his behalf*. The customer possesses the goods and the supplier is not free to tranship goods to other customers.

(Vigtil, 2008,p76)

It can be stated that these criteria include almost all aspect of a coordination process. The author also compared them to another VMI criteria from Robert (2003), in order to ensure the compatibility and relevance of the criteria. The comparison resulted positively, as the two set of criteria possess similar concepts. Thus, it is arguable that these criteria can be adopted in this study as the definition of a VMI relationship, and will be used in other discussion as well as analyses in the paper.

2.1.2. Components lead to a successful VMI relationship

2.1.2.1 Information sharing

Information plays a crucial part in creating a smooth coordination throughout the supply chain, especially when VMI is applied. When taking the replenishment responsibility, the supplier will need some type of information about the customer's demand. Vigtil (2007) concluded that there should be three issues involved in the information sharing process within a VMI relationship: type of data, transfer means and transfer frequency. Based on the results of a multiple case studies, in which successful as well as unsuccessful VMI relationships are studies, the author suggested the following:

- Type of data needed in VMI

Any information affecting customer's inventory status is valuable for the supplier, but the most important information is inventory level. Additionally, when customer is a make-to-stock (MTS) manufacturer, information regarding production schedule and stock withdrawals should be transferred; incoming orders and point of sales (POS) could also be transferred for improved forecasting. On the other hand, when customer is a wholesaler or a make-to-order (MTO) manufacturer, information on coming orders should be transferred.

- Transfer means and transfer frequency

Results from Vigtil (2007) study showed that in both successful and unsuccessful VMI relationships, electronic information transfer is applied. Thus, the author concluded that the use of such means is an enabler but not a guarantee for success. The study found a favorable attitude toward the use of integrated automatic data transmission solutions among all cases, which is in line with Simchi et al. (2000)'s statement of the importance of advanced information systems. However, the results, according to the author, is not strong enough to deny the idea that VMI can function with less integrated means, which are presented by authors such as Mattson (2002), who suggests that manual VMI is an alternative to electronic communication of inventory levels and sales data, or Waller et al. (1999.as cited in Vigti, 2007) and Ellinger et al. (1999.as cited in Vigtil, 2007). Regarding transfer frequency, periodic transfer, i.e. 24-hour or weekly updates, is concluded to be the most desirable transfer frequency, according to Vigtil (2007). The author also concluded that the data update frequency should be equal to or higher than the suppliers' re-planning frequency.

2.1.2.2. Trust

Trust is an important component of any relationship, thus it is undeniable that this is a vital part of VMI relationships as well. Vigtil (2008) suggested that there might be different types and levels of trust and commitment exist between supply chain partners, depending on duration of the relationship and previous interaction experience. Simchi-Levi et al. (2000, as cited in Vigtil, 2008) stated that there should be a certain level of trust being established and developed between the involved parties in order for VMI to be successful. This is due to the fact that among all data being transferred back and forth between parties, confidential information might be included. Thus, by involving in VMI with unreliable partners, companies risk being in an undesirable situation where the information is exposed to their competitors. Clearly, this situation should be avoided at all costs, which explains why companies only establish successful VMI relationship with partners that they already developed a good level of trust with. Another issue related to trust in VMI also concerning the performance of the other party in the VMI agreement. Accordingly, in order for VMI to be established successfully, parties should be able to demonstrate a record of long-term good performance. This notion, according to Simchi-Levi et al. (2000, as cited in Vigtil, 2008) can help develop trust and reduce the perceived risk of collaborating with a badly performed partner. Pohlen & Goldsby (2003) stated that being a vital ingredient of an VMI relationship, trust ensures that the parties fulfil their obligations, and only long term relationships built on mutual benefits and trust are likely to succeed.

2.1.2.3. Areas of collaboration

Areas of collaboration refers to which activity can be included in a VMI relationship, both the initial stage of the collaboration and along the contract period. Simchi-Levi et al. (2000, as cited in Vigtil, 2007) stated that communication is vital for solving problems arising in the beginning phase. Lapidé (2001, as cited in Vigtil, 2008) stressed that forecasting rests on demand information from the customer and thus, it is assumed that it is the supplier's task to prepare his own forecasts. Accordingly, the author did not imply that forecasting should be a joint effort. Holmström's (1998, as cited in Vigtil, 2008) pointed out that, for suppliers, it is necessary to know the re-order point and economic batch quantity before operation. Thus, it is indicated that jointly production and promotion planning is required. Finally, according to Ellinger et al. (1999, as cited in Vigtil, 2008), there are several areas that partners in VMI relationship can establish a collaboration, which are:

- pre-seasonal planning with trading partners,

- joint planning of replenishment or promotion,
- joint forecasting.

Vigtil (2008) noted that there seems to be little literature studying the possibility of collaborating in the negotiation and pre-implementing phase of a VMI relationship. The author argued that this could be strongly related to the trust issue in VMI relationships, which is discussed in the previous part of the paper. Accordingly, it can be stated that partners only establish VMI relationships when a certain level of trust is developed. Consequently, parties have reached a level of mutual understanding and come to an agreement of how to operate under a VMI program, thus making collaboration in the negotiation and pre-implementing phase irrelevant in some cases.

2.1.2.4. Product and market characteristics

Different types of product and market characteristics can impact VMI relationships differently. The ongoing discussions are all concerning what kind of supply chain can a VMI relationship suited in the most. Vigtil (2008) concluded that opinions differ and it seems that a common agreement is not yet found among various studies.

Regarding the issue of demand stability, Fisher (1997) and Xu (1996) provided two contrasting ideas. Fisher (1997) suggested that supply chains with a stable demand should focus on reducing inventory throughout the entire chain, which using VMI can be beneficial. On the other hand, Xu (1996) argued that VMI should be best suited for supply chains that have an unstable and fluctuating demand curve, as the main benefit of applying VMI is to increase information visibility which allows manufacturer to improve planning efficiency. It can be seen that Xu (1996)'s argument is in line with most of the studies regarding the bullwhip effect that have been discussed previously. All of these studies highlight the importance of information visibility, which is one of the biggest benefits gaining through applying VMI.

Supply chain characteristics can be another issue that predicts the success of VMI. Robinson, Sahin and Li-Lian (2005) stated that for MTO systems, information sharing and coordinated decision-making can reduce the supply chain costs from 0% to 35%. However, the authors argued that since MTO systems differ significantly from MTO systems, as it assumes an independent demand environment, infinitive planning horizon, and that inventory is stock in anticipation of demand. On the other hand, make-to-order supply chains operate with dependent demand relationship, short planning horizons and an inability to stock inventory in anticipation of demand. Findings from this study suggested that there are significant

operational cost savings for traditional decentralized systems (19.6%), decentralized with information sharing systems (29.5%) and coordinated supply chain systems (12.5%). However, the savings are stated to be distributed unequally along the supply chain. Additionally, for the first two supply chain systems, which are said to be applied at most companies, it was found that with the unilateral application of e-procurement technology, the buyer might lower his purchasing costs, but increase the seller's and the system's costs. In the end, the study concluded that the potential economic benefit of e-replenishment in a decentralized make-to-order system is substantial. However, potential operational improvements might be possible throughout the supply chain.

2.2. Expected benefits of VMI collaboration

There have been a number of studies concerning the potential or experienced benefits of engaging in a VMI relationship. Among all, the most frequently mentioned benefit is VMI's ability to reduce the bullwhip effect, which has been previously mentioned as one of the main reasons companies initiate inter-member logistics programs. According to Harrison and van Hoek (2008), the implication that the underlying concept of VMI, which is having the supplier take the decision on replenishment, aims to minimize the impact of demand amplification. The ability to dampen this critical impact of infrequent and large orders is said to be the key to success of VMI. This type of collaboration can also help reducing the surplus capacity and excess finished goods held by suppliers to counteract such variation.

It was also stated by the authors that the immediate benefit to a supplier engaged in VMI is the access to data on customer sales as well as inventory levels at the customer's warehouse. It is assumed that the supplier can use these data to provide better control of the supply chain, thus creating benefits for not only themselves but also the customers.

Harrison and van Hoek (2008) also discussed a long term benefit of a VMI collaboration. The authors suggested suppliers to integrate demand information into their organization and develop the ability to drive demand with it. This strategy helps replacing the traditional push scheduling based on forecasts and buffer stocks with pull scheduling, which is based on meeting known demand instantaneously out of manufacturing (Harrison & van Hoek, 2008). Vigtil (2008) reviewed a number of scientific studies and suggested two main benefits of a VMI collaboration: performance improvements by demand visibility and costs improvement. This classification was used in this paper regarding the issue of VMI's benefits.

2.2.1. Performance improvements by demand visibility

As mentioned above, VMI is said to have a direct impact on reducing demand variation along the supply chain. Many studies have confirmed that the demand variation, or the bullwhip effect in a broader aspect, is reduced significantly by the increased visibility of demand data, which is the underlying concept of VMI. Accordingly, amplification of the demand variation can be reduced if suppliers can act on demand data instead of customer order data (Vigtil, 2008).

Waller et al. (1999, as cited in Vigtil, 2008) stated that by being able to predict the demand in an early stage, suppliers can increase the flexibility as well as the delivery window. This is said to have a positive impact on both manufacturing and inventory operations. The authors also suggested that as VMI aims to increase demand visibility, it can also lead to increase in product availability, due to the increase in the time window for planning and delivery. This can be further translated into a reduction in stock-outs and a wider variety of Stock keeping units (SKUs). According to the authors, demand visibility allows the supplier to control manufactured goods and reassign loads to serve more urgent orders if the products are standardized. It is concluded that VMI suppliers might therefore experience service improvement towards non-VMI customers.

Costs reductions can also be an area of improvements with the application of VMI. Reducing demand variability allows suppliers to reduce the level of buffer stocks and lower redundant stocks, consequently reduce the inventory holding costs. Other costs improvements benefits of VMI will be discussed in the next part of the paper.

2.2.2. Costs improvements

Vigtil (2008) summarized a number of cost benefits generating from applying VMI, using a number of related scientific studies. Cost improvements of VMI implementation, according to the author, can be for both parties in the relationship, or for one whereas the other partner remains largely unaffected. Mattson (2002, as cited in Vigtil, 2008) also indicated that some of the costs might increase for one partner, but from the perspective of the entire VMI collaboration, most costs are reduced. Details of some costs benefits can be found in the table below.

Table 1

Costs Changes In Different Areas Within A VMI Collaboration (adapted from Vigil, 2008).

Type of costs	Suppliers	Customers	Total in the relationship
Transportation costs	Unchanged	Reduced	Reduced
Inventory costs	Reduced	Unchanged	Reduced
Warehouse costs	Reduced	Reduced/Increased	Reduced
Management costs	Reduced	Increased	Reduced
ICT costs	Increased	Increased	Increased
Manufacturing costs	NA	Reduced	Reduced

2.3. Barriers to the implementation of VMI collaboration

It is clear that setting up an intra companies collaboration program is not an easy task and it can face various problems in all phases. Harrison and van Hoek (2008), when discussing the concept of VMI, mentioned six distinct potential issues that can prevent organizations to achieve a successful VMI implementation. These potential problems are:

- Unwillingness to share data

This problem refers to the fact that some partners, particularly retailers, in the collaboration might be unwilling to share their marketing plans and product strategies with manufacturers. For this issue, the authors used the UK supermarkets as an example. These supermarkets have strong own brands that are competing directly with the manufacturers' brands, thus sharing information regarding marketing or products plan is an illogical strategy. This problem can occur in other markets as well, and the inability to forward necessary information will prevent VMI from functioning properly.

- Investments and restructuring costs

Adopting a VMI system implies a high level of investment from both customers and suppliers. Setting up the processes and procedures in order to understand and follow it properly takes time and effort. Some functions in both partners' organization need to be restructured, for example the customers' warehouse or material management function might be reduced or eliminated, while these functions in the suppliers' side need to be developed. These changes obviously involve investments in both time and money, which can be barriers to certain organizations.

- Lack of standard procedures

VMI's practicalities of the procedures and processes may not be transferable from one customer to another. Customers might ask for different tagging or labelling methods, and

for many industrial products, there is no bar-code standard. This lacking of standard procedures may prevent companies from engaging in VMI collaboration.

Vigtil (2008) summarized information from a number of studies and presented the following obstacles to the implementation of VMI. Some of the below mentioned issues might be the same as those mentioned in Harrison and van Hoek (2008)'s study, however there are also some other barriers. The summarized barriers are:

- ✓ Commitment and willingness to share data, reluctance to engage;
- ✓ Investments and restructuring costs, time consuming and risky implementation of systems, technology investments and expenses;
- ✓ Vulnerability, agreement on liability, trust, confidentiality and risk of information abuse;
- ✓ Quality of shared data, seasonal variations and forecasting quality;
- ✓ Ability to utilize information to improve performance;
- ✓ Geographical distance between parties;
- ✓ Inventory ownership; and
- ✓ Critical volume.

Based on this, it can be seen that the issues cover different areas in the supply chain activities, thus making the proper implementation of VMI a great challenge. It has also been shown through literature that this strategy has the potential to bring significant improvements and benefits to companies. These barriers in implementing VMI collaboration as well as the benefits it brings will be discussed and analyzed in this paper, regarding one of the relationships that the case company has with one of its customers.

3. Engineer to order (ETO) supply chain and its coordination

The case company in this paper (BD Vietnam) operates in an environment in which its main supplied items (steel products) are manufactured to either stocks or orders, while its selling items (pipes and valves) are engineered or built to order. Each of these supply chain orientations has its own characteristics which might strongly affect others, thus it is important that the characteristics of these supply chain orientations are reviewed, with a focus on ETO/BTO (engineer-to-order/build-to-order) supply chain. Additionally, as the case company is in the position of coordinating between different supply chain orientation, it is also important that coordination issues, according to the literature, are presented and reviewed. These theories will be applied in the discussion regarding how the case company coordinating between its suppliers and customers.

3.1. Types of supply chain

First and foremost, it is important that different types of supply chain are properly identified, as it forms the basis to the understanding of the ETO/BTO supply chain concept. This issue has received significant attention and has been the focus of research for a number of researchers. Most of the researchers seem to agree on a common approach toward the classification of supply chains based on “decoupling point” (Gosling & Naim, 2009; Gunasekaran & Ngai, 2005; Hicks et al., 2000). According to Olhager (2003), decoupling point or the order penetrating point (OPP) defines the stage in the manufacturing value chain where a particular product is linked to a specific customer order. Van Donk (2001, as cited in Mihiotis, 2014) stated that this concept distinguishes forecast-based production from order-based production. Olhager (2003) divide factors that affect the positioning of of the order penetration point into three groups: market related factors (delivery lead-time requirements, product characteristics and customer preferences), product related factors (modularity characteristics, customization opportunities and product structure) and production related factors (production lead-time and process flexibility). Based on this concept and the affecting factors, the author classifies the supply chains into four major types or structures as presented in the table below.

Table 2

Different Supply Chain Structure Based On OPP (adapted from Olhager, 2003).

SC Structure	Design	Fabrication & Procurement	Final assembly	Shipment
Make to stock	-----→			OPP →
Assemble to order	-----→		OPP →	→
Make to order	-----→	OPP →	→	
Engineer to order	OPP →	→		

Accordingly, the four supply chain structures can be defined as followed:

- Make to stock supply chain (MTS SC)

The idea of MTO supply chain is that production and inventory can be planned to a certain pre-defined point independent of the customer preference, which can lead to a high level of warehouse utilization. In this model, products are produced at the beginning and the supply chain is characterized by a faster response time to customers. However, it can only be applicable if the following conditions are met: product demand is absolutely stable and foreseeable; small number of product lines; and transition times between products are extensive and inventories are expensive (Mihiotis, 2014). It has been stated that the model is characterized by a lack of flexibility in the variety offered to customers, due to limited or no option for customization (Blanco, 2002.as cited in Mihiotis, 2014). Therefore, nowadays, the model is only applied at a few companies, mostly in low-value products that cover customers’ needs for an immediate response in daily use (Mihiotis, 2014).

- Assemble to order supply chain (ATS SC)

An ATO supply chain is a structure in which the decoupling point is located at sub-assemblies within the assembly process (Hoekstra & Roome, 1992.as cited in Gosling & Naim, 2009). In other words, this is the type of production in which goods or services can be gathered after the receipt of a customer’s order. In order for this concept to be functional, the products have to include basic parts that can be independently developed and stocked waiting for a customer order. This model is used when a variety of products can be assembled from a pool of basic parts (Mihiotis, 2014)

- Make to order/Build to order supply chain (MTO/BTO SC)

Gunasekaran and Ngai (2005) defines a BTO supply chain as “the system that produces goods and services based on individual customer requirement in a timely and cost competitive manner by leveraging global outsourcing, the application of information technology and through the standardization of components and delayed product

differentiation strategies". The authors also specified the differences between MTO and BTO. Accordingly, MTO includes the manufacturing of components and parts along with assembly, whereas BTO includes mostly assembly operations, where the components and parts are outsourced. Thus, it leads to the conclusion that lead-time in MTO is longer than in BTO.

These two supply chain structures both have similar aims as the Just-in-time or Lean production, in which the customers are the one that defines when and what products will be produced. In these models, production begins when a customer's order is received and confirmed. Additionally, to ensure the smooth flow of materials, consumer demands are shared across all the supply chain. This special characteristic also contributes in forming a balanced and effective production. This model, according to Mihiotis (2014), can bring certain benefits to companies, such as reduced production waste, reduced inventory holding costs, better customer lead times and flexibility to adjust to customer demand changes, etc.

- Engineer to order supply chain (ETO)

Defined by Potter et al. (1999), ETO can be understood as a standard product range offered with the added availability of modifications and customizations. This definition seems to be more fitting in Olhager (2003)'s definition of a MTO/BTO supply chain. Potter et al. (1999) also introduced the concept of design to order supply chain (DTO), where new products are designed, engineered and manufactured based on each new customer order. This concept of DTO seems to align with the ETO concept suggested above by Olhager (2003), which defines ETO as a production process where the decoupling point is located at the design stage. This definition approach is agreed upon by a large number of other researchers, such as Rudberg and Wikner (2004, as cited in Gosling & Naim, 2009), Samadhi and Hoang (1995, as cited in Gosling & Naim, 2009) or Yang and Burns (2003, as cited in Gosling & Naim, 2009).

Sharing a similar approach as the above mentioned authors, Mihiotis (2014) defines ETO as a production process in which the specifications of the developed products are based on the submitted orders. As customers' specific needs might result to different fit, form and function of the final product, the author suggested that ETO has nothing to do with mass customization. The model, accordingly, offers a high degree of customization and requires unique designs as part of the construction.

It has also been stated that within the ETO sector, there are different existing ETO structures. Wikner and Rudberg (2005, as cited in Gosling & Naim, 2009) proposed a non-linear approach to the concept, in which they decouple the engineering and production related

activities of the supply chain. The authors then introduced the concept of engineer to stock (ETS) in addition to ETO. ETS is defined as the structure in which production is processed based on a design that is already in stock. This concept is supported by Amaro et al. (1999), who discussed the differences of versatile manufacturing sectors, which are involved in a competitive bidding situation for every order, and the repeat business customer, which may receive a series of similar orders from particular customers. Based on these discussions, the authors introduced four different types of ETO which share the commonality of a high customization degree, but varying in the amount of responsibility that is managed in-house and the number and type of activities that are completed after the receipt of an order. Hicks et al. (2000) also defines four types of ETO companies: vertically integrated, design and assembly, design and contract, and design and project management. According to the authors, all four types of ETO produce outputs with high complexity level but differ in the core competencies, sources of competitive advantages, degree of vertical integration, supplier relationships and environment and types of risk.

3.2. ETO supply chain characteristics

The most distinctive characteristic of an ETO supply chain is the high level of product customization. According to Mello, Strandhagen & Alfnes (2015), ETO supply chain produces low volume of products with high variety, at the same time allowing customers to demand products that satisfy their exact needs. Each order requires some degree of engineering work to adapt existing design or create a completely new design. Due to this characteristics, it is clear that inventory of finished goods does not exist in ETO supply chains (Satvurulaki & Davis, 2010.as cited in Mello, Strandhagen & Alfnes, 2015). Thus, ETO supply chains need to maintain a highly flexible production in order to completely customize a product as required by the customer (Wortmann et al., 1997.as cited in Mello, Strandhagen & Alfnes, 2015).

For the supply chain flexibility to be successfully achieved, coordination among different business units is crucial. Hicks et al. (2000) pointed out three major phases that require coordination in ETO supply chain: tendering (sales/marketing), product development (engineering), and production. Particularly, engineering and production activities involve corresponding interdependence that demands considerable coordination effort. As stated by Hicks et al. (2000), "...missing information and engineering revisions caused by the overlapping of manufacturing and design activities are the major sources of uncertainty that complicates the management of ETO manufacturing."

The role of coordination is strongly emphasized given the increasing outsourcing activities in ETO supply chains. For example, in the past, most shipbuilding activities have been performed in-house, including the production of main equipment. However, nowadays, sourcing can cover almost every phase performed in shipbuilding (Mello, Strandhagen & Alfnes, 2015). With this intense worldwide outsourcing, shipbuilding companies have to coordinate a range of activities across several project partners globally distributed. This change, in combination with the increasingly more sophisticated and innovative products, indicates that coordinating engineering and production activities has considerable scope to improve the supply chain performance (Hicks et al., 2000; Gosling & Naim, 2009).

3.3. Supply chain coordination in ETO/BTO sector

When a company operates in the market, it is obviously crucial that its internal and external activities with partners need to be well coordinated. ETO/BTO companies operate in such environment that each product is different to the last, and the production dimensions of the supply chain are completely customized (Gosling & Naim, 2009). Thus, these supply chains rely strongly on the tight integration of the upstream suppliers of parts, the midstream manufacturer and assembler of components, and the downstream distributor of finished goods in the supply chain (Gunasekaran & Ngai, 2005). This is not an easy task for any organization, as Douma and Schreuder (2008) concluded. It requires certain level of coordination, which can be understood as the process of combining resources.

Resources take various forms, involving broad categories of assets which can be both tangible (manufacturing plants, production lines, machinery, etc) and intangible (know-how, capabilities and skills goodwill, brands and image, etc). In 2002, Håkansson and Waluszewski presented the 4R model that classified different resources into four types (figure 2): products, facilities, organizational units and business relationships. The first two resources types fall into the category of tangible resources, while the last two resources types are intangible resources.

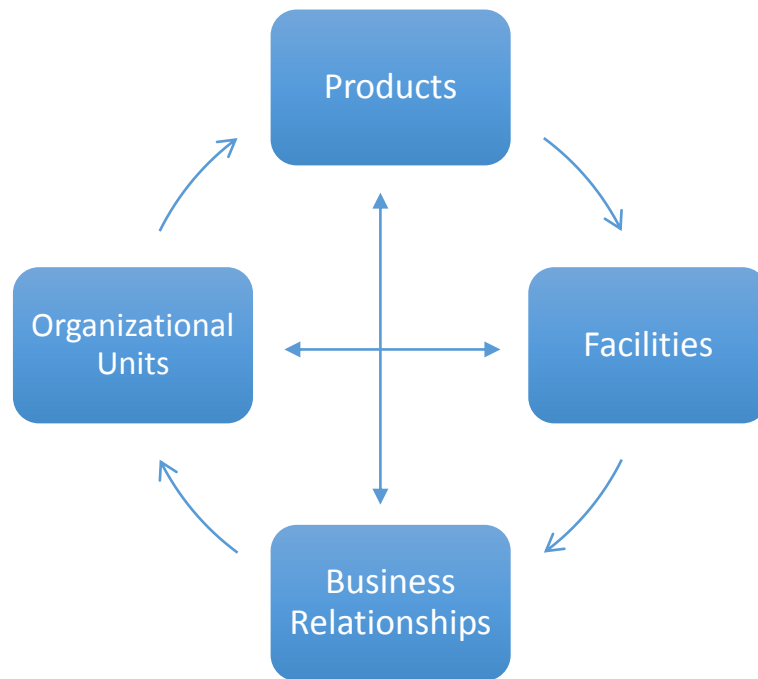


Figure 2. The 4R model of resource combination (adapted from Gadde, Håkansson & Persson (2010)).

According to Gadde et al. (2010), facilities include factors such as machinery, vehicles, manufacturing and logistics and the overall physical infrastructure in terms of roads, railways, ports, etc. The group of products resources refer to the resources contain the products that are manufactured, distributed and used at these firms. The characteristics of the facilities determine the features of products to a large extent, and vice versa. Regarding the intangible resources, it is stated that resource combinations and resource interfaces evolve in interaction within and among firms. Thus, organizational units represent important resources, as interaction processes are based on the knowledge and abilities residing inside the actors. The process of resource combine also involves capabilities and competence accessed through other firms. In this sense, the business relationships with other partners provides access to the resources of the partnering firm. At the same time, this relationship can link to the partner's other relationship, thus it can provide access to the resource residing in these relationships as well (Gadde et al., 2010).

According to Douma and Schreuder (2008), ideal markets where coordination takes place by using the price mechanism only, and ideal organizations where other forms of coordination are used, hardly exist. Markets are to some extent organized, and within large organizations, internal markets can exist. Based on these arguments, the authors introduced the concept of hybrid form, which is defined as set of organizations such that coordination between them takes place by means of the price mechanism and various other coordinating mechanisms simultaneously. The authors also present a number of hybrid forms, i.e. long-

term relations between buyers and suppliers, joint venture, business group, informal networks and franchising. In this part of the paper, two of these hybrid forms, together with the concept of vertical integration are discussed in details, as they are fitted in the context of ETO/BTO supply chains.

3.3.1. Long-term relations between buyers and suppliers

Companies offering tangible products often buy materials, parts or components from suppliers. In ETO/BTO supply chains, some of the immediate parts are designed specifically for a single product or a small group of products sharing the same specifications, for example a ship or car model. A company making parts specifically designed for these type of products usually has only one customer for that part, thus making its investment in machinery or designing for the part a transaction-specific one. Because of the high level of asset specificity, transaction cost economics predicts in-house manufacturing of these parts as the optimal choice. Nevertheless, in the real world, it is often that such parts are manufactured by outside partners (Douma & Schreuder, 2008). These suppliers are independent and usually have long-term relationships, supported by long term contracts with one or more ETO companies. It is possible that these suppliers are placing themselves in a vulnerable position where customers might exhibit opportunistic behavior, however there are also ground arguments for such strategy. First of all, a long-term contract may offer some legal protection against opportunistic behavior by the buyer. Secondly, the buyer expects benefits from future cooperation with the supplier that far outweigh any short-term financial gains that may result from opportunistic behavior. Thirdly, a buyer knows that opportunistic behavior can affect its reputation with other suppliers as a dependable trading partner, so opportunistic behavior toward one supplier will negatively affect the value of past investment in building the reputation. Finally, in some cases, the buyer can pay for or own the design and necessary machinery for the specific parts, thus reducing the level of asset specificity.

It should also be noted that when companies operate in volatile markets, or in environment where new technological developments constantly emerge, the benefits of cooperation are maximized when both parties really trust each other. Douma and Schreuder (2008) concluded that when partners trust each other, it enables them to share their technological know-how as well as coordinating the production plans through some form of joint planning. Such intensive cooperation built on mutual trust is termed co-makership (Douma & Schreuder, 2008), which relies on both trusts and safeguards.

3.3.2. Business group

Douma and Schreuder (2008) defined a business group as a group of independent firms that are nevertheless bound together by formal and informal ties. Formal ties include reciprocal shareholding by members of the group, companies owned in part by the same shareholder or group of shareholders. Informal bonds include family ties between managers of group companies and managers of group companies belonging to the same social or ethnic group. It has been stated that business groups have several advantages that are not available to a group of independent companies cooperating through market transactions. First of all, business groups offer opportunity for reducing transaction costs. For example, in some countries the rights of minority shareholders are not well educated, which leads investors to prefer investing in a company backed by a business group with a reputation for honesty, rather than a similar independent company. In such cases, group companies will enjoy a lower cost of capital than independent companies. Similarly, group companies can also use the group brand reputation to approach the customers. Customers tend to have more confidence in products or service offered under certain group brand names, as they stand as a guarantee for quality. An independent company offering the same product or service with similar quality will have to spend much more time to convince customers. Thus, business groups may help companies to overcome the issue of hidden information. Secondly, business groups may possess political clout that facilitate interaction with key government officials, which often lead to preferential access to permits and licenses and the preemption of their use by potential entrants. This is stated to be crucially important in markets with high level of regulation, which require companies to obtain permits for activities such as exiting a business, price changing or some activities related to import and export, etc. Finally, business groups usually possess dynamic capacities in setting up new ventures. They tend to be highly diversified, having capabilities covering the entire spectrum of skills associated with obtaining licenses, technology, training of personnel, etc. That dynamic capability is embodied in the group's owners, managers and routines, making it difficult to trade. Clearly, this is a solid ground for strong development.

3.3.3. Vertical integration

Another issue in supply chain management for ETO/BTO companies is vertical integration, mentioned by Hicks et al. (2000). As briefly mentioned previously in this thesis, the level of integration can be considered one way to classify ETO companies, which was briefly mentioned in the previous part of the paper. ETO companies span a continuum from in-

house manufacture of all components and assemblies, to a pure design and contract organization. Accordingly, in the first type, all items from suppliers are delivered to site and the ETO company carries out the construction and commissioning phase of the work. In the second type, all physical activities are undertaken by either suppliers or sub-contractors. Only marketing, design, procurement and project management are performed internally.

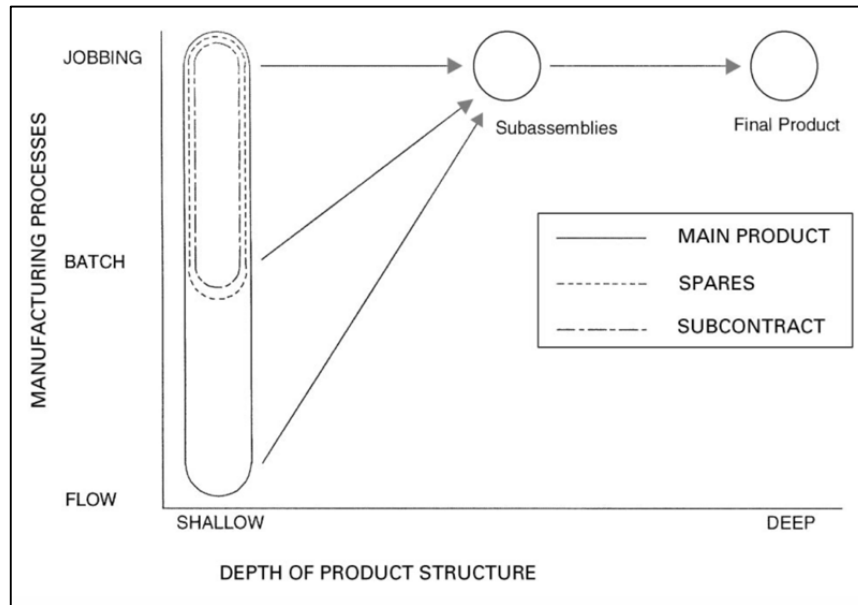


Figure 3. Vertically integrated ETO company (adapted from Hicks et al., 2000).

Figure 3 presents different level of vertical integration in a ETO company. As can be seen, a service and spare parts business supplies items with shallow product structure, or standard items. The spares and subcontracting engineering activities involve the jobbing and batch production of these standard items. For the main items, different types of manufacturing processes needed to be coordinated with common assembly and construction activities. Hicks et al. (2000) also stated that the approach to outsourcing of manufacturing activities varies from firm to firm. A common approach has been to concentrate on assembly processes, as these are considered to result in high levels of added value. Some companies have also retained jobbing process when manufacturing technologies, or other capabilities provide competitive advantages.

Hicks et al. (2000) assumed that, in considering the appropriate level of vertical integration, ETO companies look for the best results for matters such as: reconciling customer delivery times with available capacity, reducing costs, potential plant utilization, or internal and external flexibility. These factors vary from firm to firm giving rise to different levels of integration, thus making it difficult to prescribe the best practice for supply chain management in ETO companies. Hicks et al. (2000), however, observed a trend towards

vertical disintegration driven by financial pressures and the need for cost reduction. According to the authors, vertical disintegration can increase flexibility by making alternative product configurations possible, but it can also reduce the scope of concurrent engineering and the flexibility to deal with design changes.

4. Framework towards collaborative supply chain strategies

Discussions in the previous parts have suggested the necessity of collaboration in supply chain management, as well as the benefits a good collaboration can bring to all partners. However, the frameworks that are being applied at organizations in order to implement the collaborations with partners should also be scrutinized. A number of researches have been conducted regarding this issue, and consequently a number of aspects of supply chain collaboration framework have been introduced. Simatupang and Sridharan (2002) discussed five means of interventions for effective collaborative supply chain, which include mutual objectives, integrated policies, appropriate performance measures, decision domain, information sharing and incentive alignment. In 2005, the authors further developed the study and reformed the framework concepts, suggesting five connecting features of collaboration, namely collaborative performance systems, information sharing, decision synchronization, incentive alignment, and integrated supply chain processes (Simatupang & Sridharan, 2005). Holweg, Disney, Holmström & Småros (2005) had a different approach toward the concept by arguing for two factors that can lead to an effective supply chain collaboration, which are the level to which the supply chain integrates internal and external operations, and the level to which the efforts are aligned to the supply chain settings in terms of the geographical dispersion, the demand pattern, and the product characteristics.

Collaborative strategies such as CRP, VMI, CR, etc. are also a part of the supply chain collaboration studies. However, according to Derrouiche (2005, as cited in Derrouiche, Neubert & Bouras, 2008), the problem today is that confusions still exist about the described strategies, due to the similarity of their theoretical definitions. The authors stated that there has been a number of researches focusing on differentiating the concepts. For example, Simchi-Livi et al. (2000) apply the degree of partnership to differentiate the concepts; Gustafsson and Norrman (2001) proposed the organizational scope of management, the degree of operational activity and the decision-making frequency, to discuss the different collaborative strategies; and finally Cox (2001) identified the power relationships as a criterion.

Derrouiche et al. (2008) argued that these approaches made classification and comparison of different collaborative strategies possible. However, they allow only basic comparison between the collaborative strategies, without enabling researchers to understand their limit, application areas as well as the context to which one strategy is better than another. Therefore, the authors introduced a framework that will help covering these missing areas. The framework includes five criteria, namely: the extend of collaboration, objects involved

in the collaboration, nature of the collaboration, decision levels, and frequency of decisions. This framework was applied in this study, in order to understand the characteristics of each relationship that the case company is having with its partners.

4.1. Extend of the collaboration

The supply chain is composed of several units or organizations, which collaborate in a production process or in a service. In order for the collaboration to be effective, certain integration between the involved organizations are needed. The integration can come from within the organization (internal integration) or from outside of the organization (external integration). Derrouiche et al. (2008) proposed two level of external integrations, which are:

- Bi-level external integration: concerns the integration between the organization processes and its first tiers' processes (direct suppliers and customers). Its goal is to accelerate the information flows, encourage the information sharing and improve the direct collaboration.
- Multi-level external integration: a complete integration of the whole supply chain from the earliest suppliers to the end customers.

4.2. Objects involved in the collaboration

Researches have been discussing the objects involved in supply chain collaboration. Example of these objects can be data, information knowledge, etc. In this paper, the five-level objects' hierarchy introduced by Beckman (1997.as cited in Derrouiche et al., 2008) was employed. Details of the hierarchy are provided in the table below.

Table 3

Objects Involved In The Collaboration (adapted from Beckman, 1997.as cited in Derrouiche et al., 2008)

Data	Text, fact, code, image, sound, etc.
Information	Organized, summarized, structured and interpreted data.
Knowledge	Case, rule, process, model, etc.
Expertise	Fast and accurate advice, explanation and justification of results and reasoning.
Capability	Knowledge repository, integrated performance support system, etc.

4.3. Nature of the collaboration

Three types of information transfer method are discussed in the Derrouiche et al. (2008)'s paper, all of which will be applied in the context of this study.

- Make objects available (level 1): partner B puts a set of data at the disposal of partner A, which means that partner B gives the possibility of access to a part of its database to partner A, within an extranet context.
- Exchange objects (level 2): there is a sequential exchange from both directions, i.e. partner A sends a set of data to partner B and vice versa. It should be noted that exchanged data is not necessarily of same nature and context.
- Share objects (level 3): the two partners (A and B) develop and/or use the same set of data for different uses.

Concerning this aspect, Derrouiche et al. (2008) noted that in level 3, the two partners A and B can develop new knowledge with its associated values from the initial shared data. The development of new knowledge can also lead to a collective learning and strategic collective expertise (Hult et al., 2003.as cited in Derrouiche et al., 2008).

4.4. Decision level and frequency of the decisions

Collaboration exists on a continuum from strategic to operational level. Accordingly, strategic decisions concern the long term issues such as production strategy or planning and sourcing strategy. Tactical decisions are related to the medium-term problems such as forecasting, scheduling and ordering of short time materials. Finally, operational decisions concerning issues in daily events of a supply chain such as inventory deployment, detailed scheduling or management of machine breakdown, etc (Thomas & Griffin, 1996; John et al., 2000; Huang et al., 2003.as cited in Derrouiche et al., 2008).

The following cartography summarizes all above components of the collaborative supply chain framework. Within the cartography, there are two curves corresponding to the MIN and MAX of the various criteria.

- The MIN curve shows what can be executed in a collaborative relationship. For example, a collaborative strategy can permit, at the worst case (MIN curve) a partner to make available to his direct partner (who belongs to the first tier) a set of data that concerns the operational decision level.

- The MAX curve shows the best collaborative practice, in which it enables the collaborating partners to share a set of strategic information, responsibilities, risks, etc. with all the partners of the first tier.

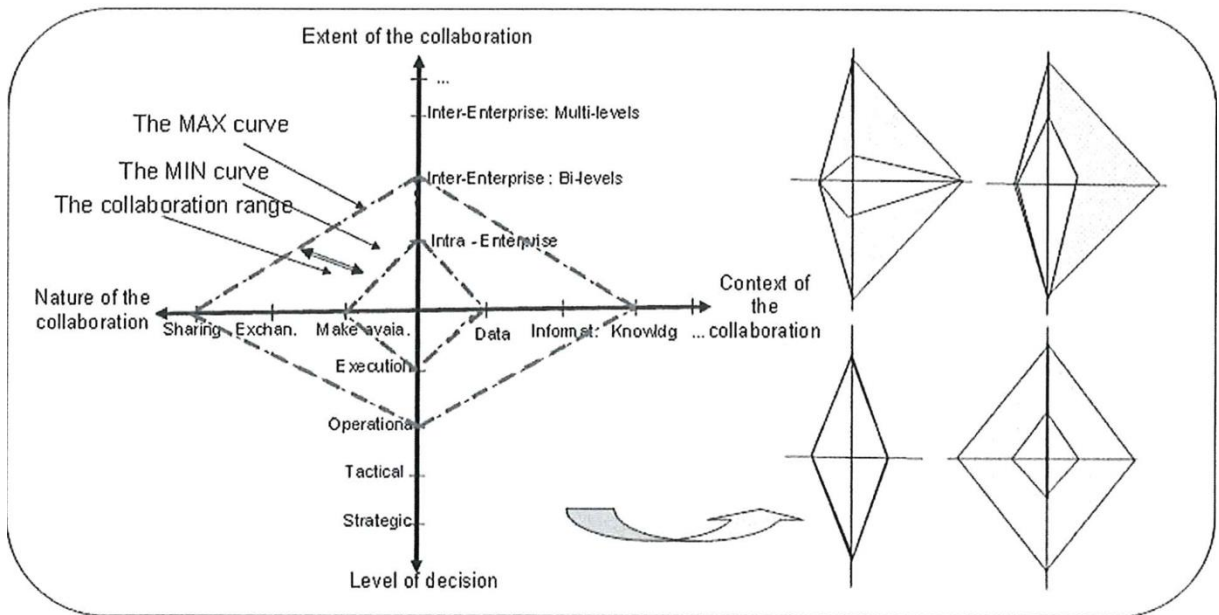


Figure 4. Cartography and some possible shapes (adapted from Derrouiche et al., 2008)

The above cartography combines four different sectors that are necessary for supply chain collaboration. As a result, it shows both the collaboration areas as well as the level of collaboration at any supply chain relationship. Thus, it is of interest to apply it to each of the business relationship that the case company is having with its suppliers and customers. Should there be a common partnership strategy being applied to the majority of the case company's relationship, it is expected that a similar pattern or shape of the model can be found. Thus, the application of this model in the paper can potentially reveal the practice of collaborative supply chain at the case company.

5. Summary of the literature

Information and material flow are two critical components of a supply chain. Supply chain collaboration involves activities that can ensure the undisrupted flow of the abovementioned elements. Within information system management in a supply chain, the communication system stands out as an important part, through which information can be exchanged timely and correctly to the respective supply chain partner. A number of communication techniques have been presented and discussed, among which EDI has been the center issue with regards to the benefits it can generate, its drawbacks as well as its suitability in different supply chain settings.

VMI has also been discussed as the main concept regarding supply chain collaborative strategy. It is believed that this is one method that can be used to overcome the issue of information disruption in the supply chain. Definitions, characteristics, successful elements as well as barriers to the implementation and application of VMI have been thoroughly presented and discussed.

Supply chain characteristics are also factors that need to be taken into consideration when discussing the supply chain collaboration. Each type of supply chains, such as MTO, MTS, ATO, or ETO has its own characteristics, which significantly affect the suitability as well as the success of collaborative strategy. In this thesis, ETO supply chain is the focus of study. This supply chain is characterized with extensively high level of customization as well as project driven. Together with the increased outsourcing activities, it is indicated that coordination and collaboration should be put into the center of focus. Thus, a number of coordinating and collaboration strategies are presented and discussed.

Finally, a combination of issues regarding collaborative strategies are reviewed and incorporated in a cartography. Four dimensions of the cartography includes context of the collaboration (types of shared data), extend of the collaboration (intra-enterprise, inter-enterprise/Bi-level or inter-enterprise/multi-level), level of decision (operational, tactical, or strategic), and nature of the collaboration (sharing, exchange, or make available). This cartography is applied in accessing the current collaborative strategies applied between the case company with its suppliers as well as customers.

Methodology

1. Research model and unit of analysis

1.1. Unit of analysis

Supply chain collaboration can be studied at different angles. In this paper, this concept has been studied via a number of business relationships that the case company, BD Vietnam, has with its suppliers and customers. Suppliers management strategies have been studied through the relationships between BD Vietnam and its main supplier in Norway and local suppliers in the region, and summarized into the overall supplier relationship management. Moreover, collaborative strategies with customers have been studied via the long term relationship between BD Vietnam and VARD Vungtau, as well as the collaborative strategies applied to the relationship with Niiigata Shipyard, a new customer that represents a new segment for BD Vietnam in South East Asia. Finally, collaborative strategies applied to a new and potentially big customer, Damen Group in Vietnam, have also been analyzed. According to Lewis-Beck, Bryman and Liao (2003), a unit of analysis is the most basic element of a scientific research project. It is the subject (the who or what) of the study, about which an analyst may generalize. Based on this definition, it can be said that each of the aforementioned relationships will be one unit of analysis in this paper. The goal of studying these units is to generate a common pattern of collaborative supply chain management strategies that are being applied at the case company, which can also be potentially applied for other business relationships either at the case company or at organizations that operate in similar environment as the case company.

1.2. Research questions and research model

Research question: *What characterizes the supply chain collaboration at the case company (Brødrene Dahl Vietnam)?*

Sub questions:

- What is the characteristics of business relationships between the case company and its suppliers?
- What is the characteristics of business relationships between the case company and its customers?
- Can a best practice be found in one or more of the relationships, and to what extent can this mode of relationship management be applicable for the development of other business relationships?



Figure 5. The research model

2. Research design

2.1. Methodological approach

For the purposes of this study, a qualitative study, particularly a study of a single firm that includes multiple case studies is the chosen methodological approach. According to Yin (2009), case study has been a common method in psychology, sociology, political science, anthropology, social work, business, education, nursing, and community planning. Schramm (1971, as cited in Yin, 2009) define the essence of a case study as the process of illuminating a decision or a set of decisions, as of why they were taken, how they were implemented, and with what result. Yin (2009) also specifies four different application of the case study method. The case study method can be used to explain the presumed causal links in real-life interventions that are too complex for a survey or experimental strategies. It can also be used to describe an intervention, or illustrate certain topics within an evaluation in a descriptive mode. Finally, the method can also be used to enlighten those situations in which the intervention being evaluated has no clear single sets of outcomes.

Based on the above argument, it is believed that the chosen approach provide the best framework for a proper investigation of the situation at BD Vietnam . It is assumed that each of the relationships that BD Vietnam has with its customers and suppliers is different from another. Thus, by using multiple case studies, it allows the researchers to deeply focus on each of these situations, and consequently being able to analyze each case as well as the general situation in the most accurate form possible.

2.2. Research process

The research will follow a typical process of a qualitative study, which according to Bryman (2001) is as follows:

- Step 1: Forming general research questions
- Step 2: Selecting relevant sites and subjects
- Step 3: Collection of relevant data
- Step 4: Interpretation of data
- Step 5: Setting the data into a conceptual and theoretical framework
- Step 6: Findings/conclusions

This paper, however, differs from other case studies in terms of the changing order between step one and step two of the aforementioned process. In this research, the site, or company, was chosen from the beginning, as the researchers were informed about the current situation at BD Vietnam and decided to investigate the problems further. Thus, the research process in this case study is presented as followed:

- Step 1: Identifying problem at the chosen company (BD Vietnam)
- Step 2: Consulting relevant theories and forming general research questions
- Step 3, 4, 5 & 6 remain the same as in the standard process

Following the qualitative approach, the thesis applied the descriptive case study method to investigate several relationship types that BD Vietnam has with its customers and suppliers. Each study of these relationship was considered as a unit of analysis, all of which were compared using the relevant theories as a foundation.

2.3. Data collection

The obtained data is the most important factor that forms the accuracy of the study's results, thus a good sample strategy must be in place before the data collection process starts. In this case, both secondary data and primary data are put into consideration, however, primary data is prioritized. According to Hox and Boeijs (2005), primary data are original data collected for the specific research problem at hand, using the procedure that fits the research problem best. Example of primary data can be a company's specific information, sales data, a specific organizational structure, etc. Secondary data are data originally collected for a specific purpose, but later are made available for reuse by the general research community. Examples of secondary data are previous researches about similar topics, historical reports or information retrieved indirectly from the research's sample or informants.

In this thesis, the necessary data include information such as: information of BD Vietnam's customers, the proportion of BD Vietnam's sales regarding each customer, BD Vietnam's suppliers, methods of communicating with suppliers and customers, etc. These information is most reliable and possibly only available at the company's database. Therefore, the only possible method for the researchers to obtain such data is through contacting the companies and ask for information access.

2.3.1. Research instruments

In terms of data collection forms, it is argued that the characteristics of data in this research is highly correlated with the level of information confidentiality. Additionally, a preliminary research revealed that BD Vietnam has a limited number of customers (less than ten), one main supplier and possibly a small number of additional suppliers as well. Due to the small quantity of data, it will be impossible for the researchers to collect quantitative data, as it will not be successfully computed by any programs. With these very reason, a suitable solution for the researchers is to use qualitative data collection forms, which in this case will be to design a lists of interview questions for BD Vietnam, its customers and its suppliers. This is the most widely used data collection form in qualitative research (Creswell, 2012).

Semi-structured interviews, which were conducted both face-to-face and via computer-assisted programs were utilized in the data collection process of this paper. Additionally, some information was also obtained via emails, based on a list of questions.

2.3.1.1. Semi-structured interviews

An interview is a short-term, secondary social interaction between two strangers with the explicit purpose of one person obtaining specific information from the other (Neuman, 2011). Longhurst (2003) identify semi-structured interview as verbal interchanges where one person, the interviewer, attempt to collect information from another person by asking questions. Although the questions are prepared in advance, semi-structured interviews unfold in a conversational manner, offering the participants a chance to explore the issue they feel are important. In this paper, the broad concepts of collaborative relationship management can be linked to various issues. Thus, it is arguable that using semi-structured interviews can help creating fruitful conversations focused on certain topics without leaving out possible factors that might affect the findings.

2.3.1.2. Emails, face-to-face interview and Skype interview

- Email

In this method, a lists of predetermined questions regarding certain topics are created and sent to the informants via electronic data system. This method is known to be effective and can can achieve acceptable response rates from an educated sample, or informant, that has s strong interest in the topic. It is also fast, effective, low cost and cover a wide geographical area. The method, however, has its own disadvantages, which are the lack of control over the conditions under which the answers are conducted; it also limits the questions that can be used. (Neuman, 2011).

In this paper, this method is applied in the early phase of the research problems formation. During this period, detailed data are relatively unnecessary, and the importance of controlling the answers is low. Thus, it can be argued that emails are the acceptable data collection method in this phase. The method is also used for data collection with two groups of informants. This is due to the inability, in terms of time, distance and financial issue, to conduct a face-to-face interview with these specific groups of informants.

- Face-to-face interview

Face-to-face interviews have the highest response rates and permits the longest and most complex questionnaires. The method allows interviewers to observe the surroundings and to use nonverbal communication and visual aid. Additionally, it is stated that well trained interviewers can ask all types of relevant questions by using this interview method (Neuman, 2011).

In this paper, the interview with the case company (BD Vietnam), the interview with its main supplier (BD Ålesund) and its current biggest customers (VARO Vungtau) were conducted via face-to-face interview. This method was chosen to ensure the quality of the collected data, to have the best possible control on the answers, as well as using the added benefits of being in the same room to observe the interview as much as possible.

- Computer-assisted interview (Skype Interview)

Skype is one of the online communication services that has been released during the last decade. In 2012, the total number of Skype users was 31 million. This service, as a free communication service, enables the possibility of calling, seeing, messaging, and sharing with people regardless of the geographical distance. In its research role, it offers researchers a novel interview method to collect qualitative data (Deakin & Wakefield, 2013.as cited in Janghorban, Roudsari & Taghipour (2013)). Due to the possibility of not only audio but also visual access, Skype interviews can be comparable to the other on-site interviewing

techniques. However, a limited visual access (usually only the head-shot) can create obstacles in observing the informant's body language as well as surrounding environment during the interview (Cater, 2011, as cited in Janghorban, Roudsari & Taghipour (2013)).

In this thesis, due to the time limit and the geographical distances, two of the interviews are conducted using the Skype interview method. These interviews include an interview with the second biggest customer of the case company, and a follow up interview with the case company. As argued above, this interview method guarantees relatively similar data quantity as what a face-to-face interview could have obtained. Thus, data collected via this method is treated the same as data collected by face-to-face interviews.

2.3.2. Informants

As the main goal of the paper is to understand the collaborative strategies being applied at BD Vietnam, it is necessary that the entire supply chain is investigated as much as possible. Thus, the chosen informants represent the case company, its suppliers as well as current customers. For each relationship, information is collected from both sides, in order to ensure the subjectivity of the findings.

At the case company, most information is provided by the general manager, as it is assumed that this informant has access to all needed information. A procurement employee from the case company was also interviewed (via email) regarding the operational issues with one of the chosen customers, Niigata Shipyard. This decision was made due to the challenges in contacting the customer. It was therefore decided that information regarding the relationship between this customer and the case company were collected only from one side, the case company.

For the main supplier, both the Procurement Manager and the Sales Manager were contacted, however information was collected via the Sales Manager only. Information from the local suppliers side was collected via the intermediary/owner company of the case company, which is the Saint Gobain sourcing office in Shanghai, China. This information was provided by the Supply Chain Manager and Sourcing Manager of the sector via emails, based on a list pre-determined questions.

Information regarding the case company's biggest and second biggest customers was collected onsite via face-to-face interviews. Informants from both companies were Procurement Manager/Sourcing Manager.

It can be argued that the choices of sample in this paper cover almost all members of the case company's supply chain. Most of the information was also collected from both sides of

the relationships. Additionally, informants from the most important source, the case company, are both in manager and operational positions. These characteristics of the informants allows the researcher to argue for a tentatively broad sample group that enables the proper exploration of all possible sides of the issues. Detailed information of the informants can be found in table 4.

Table 4

Lists Of Informants

Company	Role in the supply chain	Informant
BD Vietnam	Focal company (case company)	- General Manager; - Procurement employee (designated employee for Niigata Shipyard)
BD Ålesund	Main supplier	Sales Manager
Saint Gobain	Owner company/Intermediary to local suppliers	- Supply Chain Manager of China sourcing office (all categories); - Sourcing manager of HVAC+Plumbing category
VARD Vungtau	Current biggest customer	Procurement Manager
Damen Song Cam/Damen Group in Vietnam	Current second biggest customer	Sourcing Manager
Niigata Shipyard	Current third biggest customer	NA

2.3.3. Data collection process

The data collection process in this study started from September 2015 and lasted until late April 2016. Each phase in the process involved the collecting of data for a certain purpose. Details of the process can be found in the table below.

Table 5.

The Data Collection Process

Date	Informant	Method	Purpose
14.09.2015	General Manager (BD Vietnam)	Email	Asking for cooperation for the master thesis
15.09.2015	General Manager (BD Vietnam)	Email	Confirmation about the cooperation
23.09 – 28.09.2015	General Manager (BD Vietnam)	Email	Pilot studies: investigating potential researcher areas
04.12.2015	Sales Manager (BD Ålesund)	Semi-structured interview	- Information regarding the mother company (BD Norway); - Supplier relationship management (the main supplier's side)
14.01.2016	General Manager (BD Vietnam)	Semi-structured interview	- Suppliers relationship management (BD Vietnam's side) - BD Vietnam & VARD relationship (BD Vietnam's side) - BD Vietnam & Damen Group relationship (BD Vietnam's side); - BD Vietnam & Niigata relationship (BD Vietnam's side)
14.01.2016	Procurement Manager (VARD Vungtau)	Semi-structured interview	- General information of VARD Group and VARD Vungtau; - BD Vietnam & VARD Vungtau relationship (VARD's side)
11.03.2016	General Manager (BD Vietnam)	Semi-structured interview (Skype)	- Detailed sales information for the three chosen customers; - Supplier collaboration with BD Ålesund
23.03.2016	Sourcing Manager (Damen Song Cam/Damen Group in Vietnam)	Semi-structured interview (Skype)	- General information about Damen Group in Vietnam - BD Vietnam & Damen Group relationship (Damen's side)
11.04 – 26.04.2016	Sourcing Manager & Supply Chain Manager (Saint Gobain)	Email	Supplier management (local supplier's side)

3. Reliability and validity tests

It has been stated that reliability and validity are important criteria in establishing and assessing the quality of any research. However, there has been some discussions among qualitative researchers concerning the relevance of such tests in qualitative researches. One of the main arguments for this concern is the usage of measurements in testing reliability and validity. This is a common technique in quantitative researches, given that measurements are the main concern for this type of research. However, this is not the case in qualitative studies, thus the issues of validity and reliability would seem to have little bearing in such studies (Bryman, 2001). Nevertheless, having reliable and valid results is desirable for any research, thus these type of tests should be carried out regardless of the choice of method. It is argued by a number of researchers that different techniques of assessing the reliability and validity can also be applied in qualitative studies. Concerning case studies, Reigh (2003) introduced a set of terms, design tests as well as techniques that can be applied to assess the reliability and validity in case studies. A number of these techniques, which is presented in table 6, are applied in this paper.

Table 6

Reliability And Validity Tests In Case Study (adapted from Reigh, 2003)

Type of test	Corresponding qualitative tests	Case study techniques	Phase of research in which techniques occur
Construct validity	Confirmability	Use multiple sources of evidence;	Data collection
Internal validity	Credibility	Within-case analysis and cross-case pattern checking; Assure internal coherence of findings and concepts are systematically related;	Data analysis Data analysis
External validity	Transferability	Use replication logic in multiple-case studies; Compare evidence with extant literature;	Research design Data analysis
Reliability	Dependability	Assure the compatibility between research issues and features of study design; Use multiple researchers; Peer review	Research design Data collection Data analysis

Results from the above tests are presented as followed:

3.1. Confirmability

In this paper, a number of similar questions concerning the same subjects were used with different informants. This techniques resulted in similar answers which form the base for common findings. Although not every questions were applied with the technique, at least one question in each of the main issues (information system, VMI, and resource combination) were answered by multiple informants. Thus, it is arguable that findings from this study obtained considerable level of confirmability.

3.2. Credibility

This study only covered the business relationship within one single supply chain in the shipbuilding industry. Therefore, it might be argued that the credibility level is not as significant as desired. Nevertheless, the study did cover all necessary business relationships in a standard supply chain, including both supplier relationship and customer relationship. Additionally, a number of common findings were found across different customer relationships in the study. Thus, to some extents, it can be concluded that the study achieved certain level of credibility.

3.3. Transferability

Findings from this study are supported by earlier studies, as can be found in the discussion part. Additionally, two theoretical contributions suggested in the thesis are also supported, to some extents, by earlier studies. It is therefore can be concluded that the study achieved certain level of transferability.

3.4. Dependability

This research was conducted by a single researcher. However, 90% of the data collection process were carried out in the present of two researchers. The usage of an additional researcher has a significant affect on reducing bias during interviewing process, which is crucially important for any study. Additionally, the study was reviewed by an independent researcher from University of Oslo with more than 10 years experience in conducting scientific research. The application of these techniques allow the conclusion that this study achieved considerable level of dependability.

Cases' descriptions

1. Brødrene Dahl (BD) Vietnam and its suppliers network

1.1. BD Vietnam

BD Vietnam is the subsidiary company of the BD Group in Norway. BD Group works within customer segments plumbing, marine, oil & gas, hydropower and transportation and communications. Within the marine and oil and gas sector, which is the main focus of this paper, BD Group supplies products such as pipes, piping accessories and valves, as well as technical solutions to the customers. The group operates at 72 locations in Norway and has several subsidiaries and export business, with a total of 1,500 employees and a turnover of over 6 billion NOK. The company is part of the French industrial group Saint-Gobain. An organization map of the group can be found in figure 6 below.

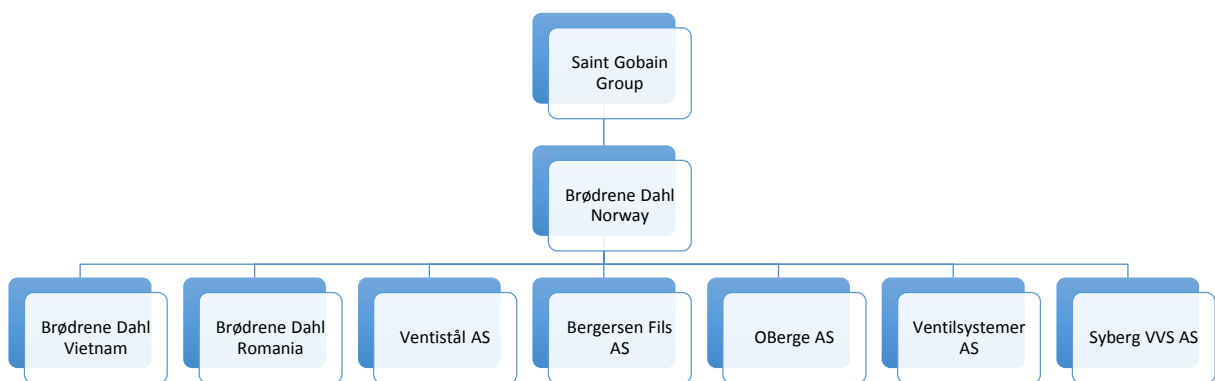


Figure 6. The Brødrene Dahl group

BD Vietnam was established in 2009, as a strategic decision toward one BD AS's long-term customer VARD AS. In 2007, VARD opened a shipyard in Vung Tau, Vietnam. As the main supplier to VARD, BD Group were asked upon the interest in putting up a warehouse in Vung Tau. In 2009, after some researches accessing the market, BD Vietnam was established. Even though being a daughter company within the BD Group, BD Vietnam is operated as an independent company. According to BD Vietnam's general manager, at the time when BD Vietnam was first established, the shipping activities in Vietnam was not too low. Besides VARD, BD Vietnam also had contracts with other customers, including the biggest Vietnamese shipyard Vinashin. From 2009 to 2012, BD Vietnam was located in the PetroVietnam Industrial Zone. In 2012, the company moved to its current location, which is next to VARD shipyard in Vung Tau, Vietnam. The decision of the current location was based on the wish to stay close to VARD, according to the general manager of BD Vietnam.

The company's day to day business is to sell equipment. Some of the the company's biggest customers include VARD shipyard, Niigata shipyard, and the DAMEN Group. The company is also approaching some customers in the region, including the Kawasaki Shipbuilding Cooperation and the Triyards Shipyards in Vietnam and Singapore. To this day, the company has 17 employees, including five people in the warehouse (with one warehouse manager), a commercial manager who supervises purchase and sales, and an administrator and finance manager for payments, invoicing controls, etc. As the BD Group is a part of the Saint Gobain group, BD Vietnam is also using HR services and some financial assistance from the Saint Gobain "Shared service center". The company's business license in Vietnam is under Saint Gobain's license.

According to the information from the general manager of the company, BD Vietnam has struggled significantly with inventory since one of its customers, the Vinashin Group went bankrupt in 2010. Items that were supposed to be used by Vinashin Group was stocked both inside and outside the warehouse, creating various inventory problems for the company, as most of them could not be sold to other customers due to the difference in the items' dimensions. This issue continued until 2015, when the company was able to select and sell some items, scrap some items, and transferred the rests of the stocks inside the warehouse. The stock level was reduced significantly in 2015, which gave the company freedom to take more risks in purchasing as well as allowing the company to approach more customers. The opportunity to reach for more customers also developed further in 2015 when the company received their own export right.

1.2. BD Vietnam and local suppliers

The main supplier for BD Vietnam is its mother company BD Norway. However, BD Vietnam also purchases a large amount of items from local suppliers. 95% of these suppliers are from China, who supply the main steel product, while the rests are purchased from Taiwan and Korea (Saint Gobain China sourcing office, personal communication, April 26th, 2016). These suppliers are managed by the Saint Gobain China sourcing office (CSO), who is also doing the same local supplier management for BD Norway, for items that BD Norway buys and imports from China. The CSO is working with several business units belong to the Saint Gobain Group. The main tasks of the office are to search for suppliers, create the portfolios, and send quotations to BD Vietnam, who will make the final decision of purchasing activities. After the contracts with suppliers are signed, this office also follows up the purchasing orders, perform quality checking, and acts as the contacting agent between

BD Vietnam and the local suppliers. This strategy clearly implies a certain amount of indirect contact between BD Vietnam and its local suppliers, which is illustrated in figure 7 below. BD Group in general has a number of suppliers from China and nearby areas, most of which are working with BD Group based on frame agreements. These frame agreements are valid for companies within the BD Group, which includes BD Vietnam as well.

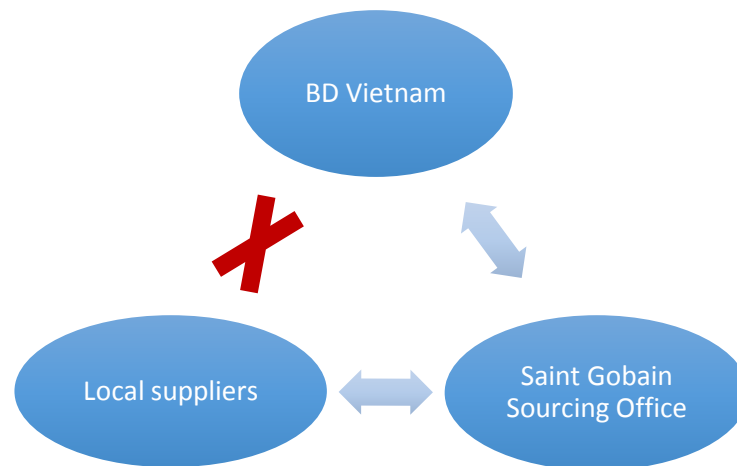


Figure 7. The local suppliers management at BD Vietnam

Two issues arise from this management strategy. First of all, there are challenges regarding quality ensure performed by the employees at CSO. According to BD Vietnam's general manager, there have been some incidents in which the received pipes were good enough according to the standard, but not good enough to the customers and to BD Vietnam's own demands. The causes of these incidents, as assumed by BD Vietnam's general manager, are due to some personal changes in CSO, which might have led to insufficient knowledge transfer to the newly employed people. In order to deal with this issue, BD Vietnam has been more involved in the instruction part of the quality check process, by arranging and sending to CSO movies and pictures of the inside and outside of the pipes. By doing this, BD Vietnam hopes to improve the quality check process performed by this sourcing office.

Another issue which relate directly to the local suppliers is delivery time. It appears that this problem has caused significant problems for BD Vietnam. The faults, as stated by BD Vietnam's, is almost entirely at the manufacturers' side. Delay is one big issue, within which communication is crucial. There have been cases when the Chinese suppliers should finish the order at certain time (for example within one month), but the actual time was longer, and BD Vietnam subsequently suffered from that delay. Another challenge is quality, as the suppliers do not meet the standard and have to redo the pipes again, which takes time. During all of the checking and communication process, the Saint Gobain sourcing office is in the

middle. BD Vietnam's general manager concluded that regarding doing business with Chinese suppliers, precise communication is crucial.

1.3. BD Vietnam and BD Norway

BD Vietnam, as a subsidiary of the BD Group in Norway, uses BD Norway as the main supplier for high technology items. The department that is responsible for supplying these items to BD Vietnam is located in Ålesund, Norway. A short interview with representatives from BD Vietnam and the department in Ålesund reveals some information regarding the relationship between these two actors.

- **Communication**

All information regarding items that BD Vietnam purchases from BD Norway are exchanged directly between the two actors. Regarding customer communication, BD Norway sometimes has direct contact with customers regarding the high-end items that they supply, however BD Vietnam is always informed about these communications. This issue will be discussed further in the part related to the collaboration between BD Vietnam and BD Norway.

- **Advantages of being in the same group**

As the member of the BD Group, BD Vietnam has the advantage of purchasing items from BD Norway at original buying price. The two companies also share a common information system which allows employees from both companies to check the inventory level as well as delivery status; the current system employed at BD Group is the M3 system. BD Vietnam is also dependent on BD Norway for technological expertise, and the technical advice from this supplier benefits BD Vietnam greatly. However, the knowledge transfer from BD Norway has only reached the top management level at BD Vietnam. The process of passing the knowledge to employees at operational level is stated to be challenging due to language issues.

- **Collaboration strategy and some challenges in the relationship**

Since the establishment of BD Vietnam in 2009, the goal was to join force with BD Norway in creating a strong Norwegian branded supplier in pipes and valves for customers in the region. This is the collaboration model that has been applied to VARD Vungtau. However, applying this collaboration model for other customers was not completely successful before the end of 2014, when BD Group secured the contract with Niigata Shipyard. To approach this customer, BD Vietnam and BD Norway joint force and present a complete package of

both standard items and high-end parts to this customer, where standard items were to be delivered from Vietnam, and the high-ends parts were to be delivered by BD Norway.

When addressing the issue of why this collaboration strategy has not been applied earlier, the general manager of BD Vietnam discussed a number of external issues. First of all, the low activity level at VARD in the beginning affected the development of the collaboration, as BD Vietnam was established initially to serve VARD. In addition, the bankruptcy of the Vinashin Group in 2009 and consequently low marine activity in Vietnam several years after that is also one big barrier stopping the collaboration from developing further. Finally, BD Vietnam's general manager stressed the issue of an export right, which BD Vietnam did not obtain until Spring 2015. The achievement of this export right has lead to opportunities for the company to reach out for more customers, which is an enabler to push the collaboration between BD Vietnam and BD Norway.

Regarding internal issues that might affected the collaboration, BD Vietnam's general manager pointed out the possibility that the BD Group in general did not see the potentials and benefits of the collaboration until recently, due to the abovementioned external issues. Another reason might be the lack of a proper collaboration method until recently. However, a short interview with the Sales Manager in BD Norway at Ålesund department revealed that there might be some people related challenges originated from BD Vietnam. Accordingly, BD Norway's Sales Manager referred to employees at BD Vietnam, with insufficient technical knowledge, handling the information incorrectly and passing the information through to Ålesund department, thus leading to miscommunication issues that affect the handling of customer's requirements throughout the collaboration. BD Norway's Sales Managers also stressed that these challenges are mostly people-related and not so often originated from information system applied within the group.

2. BD Vietnam and its customers

2.1. BD Vietnam and VARD Vungtau

VARD Group is the major designer and shipbuilder of specialized vessels for the oil and gas industry. The group operates globally with ten modern shipyards located in four different countries: Norway, Romania, Vietnam and Brazil, with the head quarter in Norway and the total number of employees counts up to nearly 12,000 people. In 2015, VARD Group delivered 12 vessels, all developed with close partnership to its partners and built to meet their specific needs (VARD, 2015).

In Vietnam, VARD Vungtau is a fully integrated shipyard that covers activities from hull construction to full vessels delivery. In 2015, three out of 12 delivered vessels were from this shipyard in Vietnam. The shipyard is well-equipped to handle complex project management that measures up to the same international standards of the more established yards in Europe, and had during 2015 commenced work on its first OSCV (Offshore Subsea Construction Vessel) project. Yard utilization at the Vietnam yard remained robust during the year 2015 despite the termination of two vessel contracts in the first quarter of the year. The first of the two terminated vessels has since been delivered to VARD Shipholding Singapore, while construction of the second vessel is still progressing. Both vessels continue to be actively marketed for sale. With a stellar track record of timely vessel deliveries and positive feedback from their customers, VARD Vungtau has established itself as a highly valued part of the Group (VARD, 2015).

As mentioned in the previous part, VARD Vungtau is currently BD Vietnam's biggest customer. The two groups, BD Group and VARD Group, have had a long partnership history. The establishment of VARD Shipyard in Vietnam in 2007 led to the establishment of BD Vietnam in 2009. Besides working based on a frame agreement, the two companies have constantly strived to strengthen their relationship. At the moment, the current relationship between the two companies, which according to both BD Vietnam's general manager and VARD Vungtau's Procurement Manager, is a win-win relationship. This relationship entitles a certain amount of trust from both sides, and an attitude of benefits for both. To this day, sales to VARD Vungtau counts up to 55% of BD Vietnam's total sales, while the amount of supplies VARD Vungtau purchase from BD Vietnam counts to about 20% of VARD Vungtau's total local purchase. BD Vietnam is the only standard pipes and valves supplier for VARD Vungtau in the region, but VARD Vungtau also purchases high pressure pipes and valves from other suppliers in Norway.

Regarding operational procedure, VARD Vungtau and BD Vietnam maintain constant contact and information exchange. According to BD Vietnam's general manager, the projects' principle is almost according to Vendor Managed Inventory. VARD Vungtau's idea in the collaboration with BD Vietnam is that BD Vietnam will be the warehouse to keep VARD Vungtau's redundant stocks, so that VARD Vungtau will have as few stocks as possible. Therefore, for the items that need to be kept on stock at BD Vietnam's warehouse, BD Vietnam is kept up to date frequently about the items' stock level in VARD Vungtau warehouse. Additionally, the frame agreement between the two companies states that BD Vietnam should always have the standard items for one ship-set, so that VARD Vungtau can

purchase immediately should there be a sudden project. Other items are purchased based on orders. These items are usually purchased early in the beginning of the project based on a list sent from VARD Vungtau, and kept at BD Vietnam's warehouse until VARD Vungtau needs it and orders them. This strategy, according to BD Vietnam's general manager, is to avoid delay.

Information is also updated frequently during a project. In the beginning of the project, the two companies would have a meeting, in which information about items that are on stocks, items that are needed, the delivery time, etc. are discussed, so that these items can be scheduled on the production plan. The lists of items needed for each project, as mentioned above, are constantly updated and shared between the two partners. This action, as stated by VARD Vungtau, is not applied for other suppliers. Meetings are also arranged after the production has started in order for the two companies to update the status of these items. As the two companies located right next to each other in Vung Tau, representatives from both companies confirmed that meetings can happen a couple of times per week during a project. VARD Vungtau's representative concluded that the success of this collaboration is based on the long term history between the two groups, as the exact same principles are applied between VARD Group and BD Group in Norway and Romania.

Despite the close relationship, the two companies do not integrate in each other's enterprise system. Information is exchanged solely based on emails, phone calls and meetings. This communication method applies also when VARD Vungtau has some sudden changes in order and needs to communicate the changes to BD Vietnam. The two partners also do not have capital investment in each other's company. However, a knowledge sharing program has recently been initiated and was set to be implemented in Spring 2016. This program is considered significantly beneficial for both companies, as confirmed by representative from both sides. Nevertheless, the implementation of the program has been delayed due to the costs saving strategy from VARD Vungtau in order to deal with the current downturn in oil and gas activity.

2.2. BD Vietnam and Niigata Shipyard

Niigata Shipyard was first established as Niigata Engineering by Nippon Oil Cooperation in 1895. In 1905, the shipyard started its shipbuilding activities in the Irifune area of Niigata city, Japan. In 2003, the company changed its name into Niigata Shipbuilding & Repair, INC, and since then continued expanding its business activities which include new shipbuilding,

ship repairing and steel production work. The company now has about 200 employees, and acquires the capital of 300 million Japanese Yen (www.mes.co.jp, 2011)

BD Vietnam, together with BD Norway, started working with Niigata since December 2014. The two partners have collaborated in four projects, among which two projects are finished and two projects are approaching the end. In 2015, the total sales to Niigata counted up to 9.4 million NOK, approximately 16% of the total sales.

For this customers, BD Vietnam only supplies pipes, fittings and flanges; other valves packages and high technological items are supplied by BD Norway. The logistics of the collaboration is arranged that BD Vietnam and BD Norway sell and ship their parts of the order individually. Thus, the core concept of the collaboration is that BD Vietnam and BD Norway have a joint force in providing the customer technical expertise in the engineering process, and present a complete package of items. This, according to BD Vietnam's general manager, seems to fit the customer's needs. BD Vietnam's general manager believes that the separated logistics arrangement should not cause troubles for the customer in receiving the items at the warehouse, at least for items sent from BD Vietnam as these are non-high technical products.

In terms of communication during the project, the methods used are mainly emails and phone calls. There is one designated person at BD Vietnam and one designated personal at BD Norway responsible for the Niigata projects. Throughout all communication, these designated employees are updated constantly with information regardless of whether the issues are related to items from Norway or from Vietnam.

This is the first time BD Group works with Niigata Shipyard, yet Niigata is already considered an important customer for BD Vietnam, given the relatively significant sales share. However, BD Vietnam's general manager stated that it is very difficult to see if the relationship can be continued, as it is very project based. Niigata builds vessels according to both JIS and DNV standards, where JIS is the Japanese Industrial Standard, and DNV is the Norwegian standards (Den Norsk Veritas). The projects that BD Group has been working with Niigata are for vessels built on DNV certifications, and BD Vietnam believes that should Niigata plans to build more vessels using this standard, it is possible that the BD Group can be the supplier as the group had good feedbacks from this customer.

2.3. BD Vietnam and DAMEN Group Vietnam

DAMEN Group is a globally operating company that has built over 5,000 vessels for customers in nearly every country in the world, from central Africa to the smallest island in

the Pacific. The headquarters of the DAMEN Shipyards Group is in the Netherlands, however the group owns 35 shipyards in 14 countries, among which 15 shipyards are located in the Netherlands. Annually, there are up to 150 vessels are manufactured at one of the 35 owned shipyards or at numerous partner yards (DAMEN, 2015).

DAMEN business in Vietnam started about 12 years ago with partner shipyards namely the Vinashin, Song Cam, Song Thu and 198 shipyards. In 2014, DAMEN bought 70% of the Song Cam shipyard and officially started the DAMEN Songcam Shipyards, the first formal joint venture of the group in Vietnam. Nowadays, the DAMEN Group in Vietnam has totally 6 joint ventures and collaborations in Vietnam, including Song Cam Shipyard, Song Thu Corporation, Company 189, Ben Kien Shipyard, Ha Long Shipyard, and DAMEN Songcam Shipyard. DAMEN Songcam Shipyard is an assembly yard which only builds small tug boats, with the capacity of about 40 ships a year, and it is stated to be the preferred production location for DAMEN tug and workboats up to 60 meters long. Construction of the yard is continuing, and the yard will soon be able to increase its capacity to produce up to 50 hulls and outfit up to 80 vessels a year (DAMEN, 2016). Regarding the business in Vietnam, representative from DAMEN Songcam stated that Vietnam nowadays is the biggest production location for the DAMEN Group, with growing potential.

BD Vietnam started working with the DAMEN Group in 2013 but the sales portion at this time was only less than 1%. In 2014 the sales increased to more than 3 million NOK, and by 2015 this number increased greatly to 17 million NOK, which represents about 24% of the total sales. This is the first time BD Vietnam collaborates with the DAMEN Group, however within the BD Group, BD Romania has been collaborated with DAMEN shipyard in Romania from before. With the investment to turn DAMEN Songcam into DAMEN's own shipyard, it has been a goal for the company to reduce the amount of supplies sent from the Netherlands and started using local supplies instead. The first contact between DAMEN Vietnam and BD Vietnam was from 2.5 years ago. Before that, there has been some contact between the Song Cam yard and BD Vietnam, but the purchase orders have been small.

DAMEN Songcam builds standard ships, so the items are similar for almost every ship. BD Vietnam sees the potential of this customer and started offering to stock items for DAMEN. The relationship started developing, and according to DAMEN Songcam's sourcing manager, BD Vietnam now has good knowledge of DAMEN Songcam's needs. DAMEN has more than one suppliers for pipes and valves in the region. However, other European suppliers have longer lead-time than BD Vietnam, other local suppliers are still considered risky, and BD Vietnam has developed good knowledge of DAMEN Vietnam's business.

Therefore, for DAMEN Songcam, BD Vietnam will be the prioritized local supplier. For the entire DAMEN Group, this is still an ongoing discussion. However, as DAMEN and BD in Romania have developed a good relationship (with a frame agreement) prior to the collaboration between BD Vietnam and DAMEN Vietnam, the sourcing manager at DAMEN Songcam believes that further collaboration between the two groups are to be expected.

The reason to collaborate with BD Vietnam, according to DAMEN Songcam's representative, is not directly related to the Saint Gobain brand. As stated by the sourcing manager of the company, reliability is very important for DAMEN, especially when the company start approaching the local suppliers. BD Vietnam, working with the Norwegian standards, is considered a reliable supplier that delivers good quality products. To DAMEN Songcam, BD Vietnam is considered the best supplier in Vietnam at the moment. Should a frame agreement can be reached, BD Vietnam is also considered to setup a warehouse next to DAMEN Songcam's warehouse in Hai Phong, Vietnam. This will be 100% managed by BD Vietnam. This idea has been initiated since early 2015. However, this issue will be decided between the managers of BD Group and DAMEN Group.

Regarding communication between the two companies, only emails and phone calls are used to exchange information. The overall quality of communication so far is considered good by both DAMEN Songcam and BD Vietnam. The communication process starts by DAMEN Songcam generating a lists of needed materials from the system and send to BD Vietnam via email. BD Vietnam then checks the inventory status for the items and give information for items that are needed to be purchased, together with the lead-time. Discussions on items before the purchasing process is also carried on via email. BD Vietnam store some standard items for DAMEN Songcam in the warehouse, however, difference in items' dimensions for some projects is to be expected. Thus, this is an issue needed to be discussed between the two companies before a PO can be sent.

Differences in items' standards and certifications can be considered a challenge in the future of the business relationship. Accordingly, ships built by DAMEN Group follows the DIN standards, while items and parts in the local region, including items from BD Vietnam, are built based on the ASTM standards (Aerospace and Shipping Standards). The two standards are slightly different in terms of pipe size, thickness, or dimension, etc. Thus, should BD Vietnam have items available for DAMEN Songcam in the warehouse, but the items are in ASTM standards, DAMEN Songcam needs to have an internal discussion before deciding if the items can be used for the project. This prolongs the communication before a project,

which is not desired for the marine industry in which time is crucial. Additionally, for every project, DAMEN Songcam have received items that are slightly different than desired due to the above mentioned difference standards, and this is considered a challenge for the company. DAMEN Songcam suggests that deciding on a set of standards is an urgent issue to be decided internally in DAMEN Group. This decision will largely affect the outcome of a frame agreement between DAMEN Songcam and BD Vietnam.

Discussions

1. Collaborative practices in BD Vietnam at strategic level

1.1. The roles of business relationships and partnerships

The collaborative practices at BD Vietnam are characterized by the extensive involvements in different business relationships, each of which generates certain experience and knowledge which are argued to be beneficial to the company. These involvements in different layers of partnerships can be seen as the strategy-level decisions that helps forming the applied operational practices at BD Vietnam.

As mentioned in the literature review, the nature of the shipbuilding industry, as ETO supply chains, is characterized with high level of customization as well as outsourcing. These characteristics indicate the importance of coordination, which essentially is the process of combining resources, in order to ensure the success of the entire supply chain. Companies in general are continually involved in efforts to utilize the network's current resource constellation in the best possible way. Some of these resources are located within the focal company, but there are also resources that are only accessible via direct relationship with business partners (Gadde, Håkansson & Persson, 2010).

In this thesis, each of the business relationships indicates a certain level of resource combining as a collaborative strategy. The focal company is a member of a mother company in Norway, from which significant resources are open to access. At the same time, the BD Group is a part of a global business group which has access to diverse types of resources that are greatly beneficial, and with open access, to the focal company. The long term relationship between BD Vietnam and its main customer, VARD Vungtau, also strikes as a great resource that are well utilized by the focal company in its business. Finally, its current business relationship with the local customers from South East Asia can also be seen as possible resources to utilize. Details of these relationships and the resources it provides will be discussed in details as below.

1.1.1 Benefits of being a member of the Saint Gobain Group

- Access to market knowledge

Being owned by Saint Gobain is considered important by BD Norway. As stated by BD Norway's representative, although not significantly strong in the maritime sector, Saint Gobain group does own a number of companies that have marine activities. Thus, by being a member of the group, it allows BD Group to get access to market information shared by

other members. This common marketing group is called Saint Gobain Marine Application. The information is available for all members in the group, thus, BD Vietnam, as a daughter company of BD Norway, also has access to the information. Clearly, this is a classic example of utilizing intangible resources accessed via a business relationship. Each member of the Saint Gobain Marine Application has their own business relationships, which accordingly will generate certain amount of market knowledge and other resources to that member. Consequently, by joining the knowledge and resources from different members of the group, it creates an overall large and powerful resources that are greatly beneficial to all members of the group, which includes BD Group and BD Vietnam as well.

- Reputation

Reputation is another valuable resource that BD Vietnam can gain via Saint Gobain. In Europe, BD is a strong brand in pipes/valves/fittings and HVAC systems supplies for the marines and oil/gas sector. When the company is working within this geographical region, or with partners from this area, the BD brand alone might be enough. This is confirmed by both VARD and Damen, the biggest and second biggest customer of BD Vietnam. However, once the company start developing globally, the name with larger branding effect is needed. This name, or resource, is accessed via the Saint Gobain Group. It is assumed that utilizing this resource can be one of the reason that led to BD Vietnam's success in approaching the Japanese customers. However, as information from these customers are not provided, it is still an assumption and not a solid conclusion.

- Reduce administration costs

Another benefit for BD Vietnam by being a part of the Saint Gobain Group is the reduction on administration management costs. All heavy financial service, HR service, and other administration service for BD Vietnam is operated by Saint Gobain. The utilization of administration capability allows BD Vietnam to cut costs on administration and focus on the day to day business instead. This service, or capability, is an organizational resource belongs to Saint Gobain, which is accessed by BD Vietnam via the business/member relationship with Saint Gobain.

- Local supplier management

Finally, one important activity that BD Vietnam benefits greatly from being a member of the Saint Gobain group is the shared sourcing center, which manages the local suppliers for BD Vietnam. This service, apparently having some problems of its own, brings a number of possibility for BD Vietnam. First of all, as Saint Gobain is a big group that operates in different fields, it is argued that the group should have access to a larger supplier base than

what BD Vietnam or BD Norway could have achieved on their own. Secondly, Saint Gobain does have a sourcing center on its own that includes a triangle of Sourcing, Supply Chain Management and Quality Control, dedicating to the activity of supplier management. Thus, it is assumed that the combination of concentrated knowledge and ability in this sourcing center can lead to sub-par performance. Additionally, it is stated that the sourcing center is managing supply bases for multiple units within the Saint Gobain businesses, including both BD Norway and BD Vietnam. It can therefore be argued that the sourcing service can continuously learn and develop through managing different supply bases, which in turn will be beneficial to member companies that use the service. Obviously, this is another good example of accessing intangible resources through business relationships. This collaboration and the shared marine knowledge activity in the Saint Gobain Group previously mentioned are also argued to be the type of continuously developing resources based on the contribution of group members. The ideal scenario is that each group member contributes certain resources to the development of the group resources, which in turn are beneficial for them as well. The cycle continues and the group, as well as its member, achieve continuously growth.

1.1.2. Benefits of being a member of the BD Group

- Reputation

As mentioned above, BD Group has relatively good reputation in the industry, especially in the Western areas. Therefore, being a member of the BD Group enables BD Vietnam to use this resource to approach customers, especially Western companies that operate in the South East Asia region. BD Vietnam's representative confirmed that in the development plan, Western customers are the main target, partly due to the similarity in business culture. However, it can also be understood as a way to utilize the strong brand name of BD Group among these customers. As stated by BD Vietnam's general manager, this brand name is actually the door opener to many customers in the South East Asia region (personal communication, March 11th, 2016).

- Business network

Benefits of being in the BD Group is also related to its global business relationship. A clear example of this is the long-term relationship between VARD Group and BD Group, that essentially lead to the establishment of BD Vietnam as the supplier to VARD Vungtau. The two groups originated from Norway, and both have companies in the same countries (Norway, Romania and Vietnam). Thus, by utilizing the group to group business

relationships, BD Vietnam can benefit greatly. This is also suggested by BD Vietnam's representative, who confirmed that the company can learn a lot from VARD's previous projects with BD Vietnam. This resource enables BD Vietnam to increase its level of customer's understanding. A similar approach can be done with the potential customer DAMEN Group. The relationship between BD Group and DAMEN Group is not as strong as BD Group's relationship with VARD Group. However, the two group also have companies in Norway, Romania and Vietnam. The relationship between BD Romania and Damen Romania is said to be successful, and there are potentials for the relationship between the two companies in Vietnam. BD Vietnam believes that it is possible for the the company to learn from BD Romania in understanding DAMEN's business. At the same time, DAMEN Vietnam (DAMEN Songcam) believes that the relationship between the two groups can be strengthen based on the good collaboration in Romania and the potentials in Vietnam. Should an agreement be reached between the two group, it will be greatly beneficial for BD Vietnam in its business with DAMEN shipyards in Vietnam.

- Technical knowledge

Technical knowledge is another resource that BD Vietnam can access through being a member of the BD Group. In the beginning of BD Vietnam's establishment in Vungtau, the company depended largely on BD Group for technical advice. This dependency is no longer as strong as it used to be, as confirmed by BD Vietnam's representative. However, BD Group's technical resource is now utilized by BD Vietnam via the joint force arrangement, which was mentioned in the case description. The combination of technical knowledge allows both companies to approach customers as a strong force, thus it can be seen as beneficial for both BD Vietnam and BD Norway in attracting customers and securing contracts.

1.1.3. Benefits of a long term partnership with VARD

- Technical knowledge

It is undeniable that market, industry, and technical knowledge are among the resources that BD Group in general, and BD Vietnam in particular, can access via the long term relationship with VARD. The access to the knowledge and capabilities can be illustrated through the high level of information exchange between the two companies in Vietnam, especially in terms of engineering knowledge. This characteristic also fits into Douma and Schreuder's statement (2008), referring to the ability to share technical know-hows and coordinating production plans through joint planning.

- Business model

In terms of company to company collaboration, the resource and knowledge that BD Vietnam can access via its relationship with VARD do not stop at only information sharing. In fact, the VMI model, or the collaborative strategy, that is applied between VARD Vungtau and BD Vietnam, is a great resource that cannot be generated if the relationship is not established. Via this VMI model, BD Vietnam increases its knowledge in warehouse collaboration management through being a second warehouse for VARD. The close relationship also allows BD Vietnam to get access to industry knowledge and market information. These accessed resource are utilized by BD Vietnam and used to approach other customers. As mentioned in the cases' descriptions, the model with VARD is partly applied to Niigata Shipyard and possibly to the newly acquired businesses Kawasaki Shipbuilding Corporation and Triyard Shipyards. The model, to a larger extent, will also potentially be applied to DAMEN as well, as BD Vietnam had proposed to set up and manage a warehouse next to DAMEN Songcam in Haiphong, once a frame agreement between the two companies is reached. Clearly, this plan shows the utilization of resources generated through the long term relationship with one customer, to other potential customers.

1.1.4. Summary of possible benefits brought by business relationships and partnerships

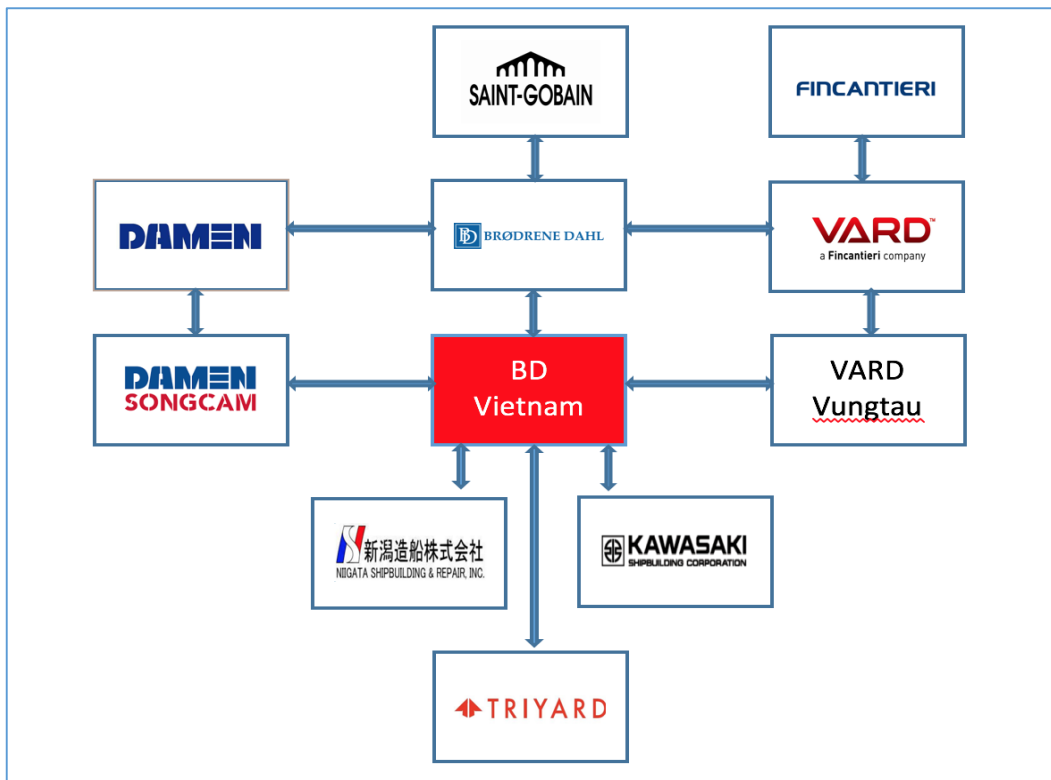


Figure 8. Possible resources to be accessed by BD Vietnam

Beside the abovementioned core partners, BD Vietnam's network also includes several customers in the region. Among them, the Niigata Shipyard stood out as one of the main contributors for the sales increase at BD Vietnam in 2015. The company also looks to DAMEN Songcam and other DAMEN's partnering shipyards as potential customers. At the same time, benefits to expand the network further in the South East Asia region also results in the new business relationships with Kawasaki Shipbuilding Corporation and the Triyard Shipyards. The relationships with the South East Asia customers are relatively new. However, it is expected that these relationships can pave the way to get into this market for BD Vietnam. Altogether, these business relationships, as illustrated in the above figure, form a network that has the potential to bring a number of benefits to BD Vietnam. The benefits, as discussed previously, can be generated both internally (via the BD Group and Saint Gobain Group), and externally (from the customers). Internally, the benefits are reputation, workforce, network utilization or knowledge transfer. Externally, the benefits cover technical knowledge, business culture, or experience, etc.

1.2. Engineer to order or make to order

As mentioned earlier in the literature review, BD Vietnam operates in an environment where their customers and suppliers work with different concepts. Their customers, the shipbuilding companies or shipyards, work in a project based environment, thus ETO is assumed to be the dominating concept. In terms of suppliers, BD Norway, who is the main supplier to BD Vietnam, supplies highly technical items, thus ETO is also assumed to be the applied concept in this company's supply chain. However, BD Vietnam is mostly responsible for standard parts of the engineer to order ships, thus certain MTO strategies are expected to be applied in the collaboration between the company and its local suppliers. Based on all these supply chain characteristics, it appears that BD Vietnam are operating in a mixed supply chain environment of both ETO and MTO strategies.

Collected data throughout the projects confirms the ETO characteristics of BD Vietnam's operating environment. It is a general understanding that production, which in this case is sub-productions and orders to sub-suppliers, does not start until an order is placed. This characteristic is shown through the collaboration processes with the customers, which are presented in the quotes below.

Before every project starts, when we have the MTO, then I go to VARD with the complete stock lists of the MTO, and I show them what we have on stock, what needs to be ordered, what is the delivery time for this, etc. So everything on this MTO can be scheduled on the

production plan... (BD Vietnam's general manager, personal communication, January 14th, 2016)

We always contact first before we send the PO [to BD Vietnam]...because sometimes they have materials that are a little different in dimensions, so we have to check if we can use them...There are often more materials added to the needs of the yard...the ships are not always similar, there are always different materials installed on board, so it is difficult for them to know exactly what we need... (DAMEN Songcam's sourcing manager, personal communication, March 23rd, 2016)

Nevertheless, at BD Vietnam, there are also MTS practices. The inventory management at BD Vietnam is run by both automatic system and manual check, which are reported weekly. The manual check is Excel based, which is based on previous projects and the ship-set included in the frame agreement with one of the customers (VARD). It is, however, indicated that the inventory at BD Vietnam are not simply follow the projects, but in fact some calculations are taken into consideration in deciding the inventory level.

In this manual check, which is Excel based, we have the minimum and the maximum. The maximum is not so important but the minimum is very important. This is based on previous projects, and the ship set that we have in the frame agreement with VARD, but at the same time, a lot of the same items are also used by other customers, so the minimum quantity may have to be higher than the ship set. So, all of these calculations are taken into consideration of the minimum quantity we need to have. (BD Vietnam's general manager, personal communication, January 14th, 2016)

The above statements indicate a certain level of MTO/MTS practice, in which inventory level needs to be calculated based on forecasts. With VARD, forecast is not needed, however it is needed for other customers (BD Vietnam's general manager, personal communication, January 14th, 2016). Additionally, BD Vietnam stated that the calculation of the inventory level takes into consideration the previous projects. With the shipbuilding industry being heavily customization, it is assumed that previous projects in this case refer to more than just the amount of items needed, but also the specification of the items. These specifications might be different from one customer to another, and even for the same customer, it might be different from one project to another, as stated by the DAMEN Songcam's Sourcing Manager (personal communication, March 23rd, 2016).

1.3. Summary of collaborative practice at strategy level in BD Vietnam

Based on the above discussions, it can be concluded that collaboration practices at strategic level in BD Vietnam is in fact characterized by the extensive network of business relationships. First of all, BD Vietnam get access to valuable resources through the partnership with the Saint Gobain Group. Second of all, the company also benefits from the group to group business relationships. Accordingly, the strong relationship with VARD Group leads to the establishment of BD Vietnam, as well as the formation of the current collaborative practices between BD Vietnam and VARD Vungtau. Finally, the current relationship between BD Group and DAMEN Group will also have certain effects on the future of business relationship between BD Vietnam and DAMEN Songcam as well as other DAMEN partnering shipyards in Vietnam.

The characteristics of the operating environment in BD Vietnam can also an influence to the collaborative strategies at the company. Based on the above discussions, it can be tentatively concluded that BD Vietnam is operating more in the ETO environment rather than MTO/MTS environment. The characteristics of the products allow certain MTO/MTS practices, which are shown to be applied in the inventory management in BD Vietnam. Nevertheless, the shipbuilding industry itself, which are project based and highly customized, requires BD Vietnam to follow the ETO principles closely, so it can response in the most adequate way to its customers.

The above discussions, however, only cover the collaboration practices at strategic level. To properly understand the concept in this case, it is necessary that practices at operational level are also analyzed and discussed. At this level, it is believed that the practices can be analyzed via the tactics applied in the day to day business relationship between BD Vietnam itself and its customers as well as suppliers. These tactics, in the limitation of the paper, are grouped into information exchange and projects based collaboration practices. It should be noted that the collaboration between BD Vietnam and VARD is considered successful, as shown via the collected data. As has been shown, the model has been applied to more than one customers, with different extends. Thus, it would also be interesting to analyze these tactics, with the different level of application regarding different customers. It is expected that a certain pattern of information sharing, as well as the operational strategies applied to different customers other than VARD Vungtau, can be revealed via these analyses, which are presented later on in the paper.

2. Collaborative practices at BD Vietnam in operational level

2.1. Information exchange in engineer to order environment

2.1.1 Information sharing with suppliers

- BD Norway

BD Vietnam and BD Norway shares a common data warehouse that is accessible for employees from both companies to check and follow. BD Vietnam's general manager confirms that all information regarding any projects that involve BD Vietnam are always updated when the projects are in process.

Say for example, according to VARD, we have the list, the MTO, and we are supplying according to this list, which is updated from time to time. This list is kept in a shared data warehouse, so everybody in sales can go in and see what has been delivered, what is updated, etc. (BD Vietnam's general manager, personal communication, January 14th, 2016)

In terms of information quality, the information shared between the two parties is not only readily accessible for both parties, it is also assumed to be relevant for the projects and exchanged at high frequency. However, BD Norway stated that there are still room for improvement in terms of communication between the two partners, as there are occasionally communication problems that are related to the inadequate level of technical knowledge among BD Vietnam's employees.

...sometimes the information we get from our colleagues in Vietnam is not clear enough, it can be technical issues that we have to check out and so on...I do not see it as a big problem, but it is one of the things that if you improve the communication, you can get it of...It [the miscommunications] is more related to the products... If our staff in Vungtau increase the knowledge about the products, you can also reduce this problem...(BD Norway's sales manager, personal communication, December 4th, 2015)

These problems indicate a need for certain level of information accuracy, which can be concluded to be not yet optimal in this case. However, beside this issue, the exchanged information in this case remain relevant, easily accessible and are exchanged at high frequency. Thus, it can still be tentatively concluded that this is shared information with high quality, according to the definition of information quality introduced by Zhou and Benton (2007). Additionally, BD Vietnam's general manager confirms that the model of customers' follow-up at BD Norway has also been adapted in BD Vietnam (personal communication,

January 14th, 2016). This statement indicates a strong level of not only information but also management knowledge that is being shared between the two companies. Given the characteristics of BD Vietnam being a member of BD Group, this extensive level of information and knowledge exchange can be considered adequate and should be expected.

- Local suppliers via the Saint Gobain CSO

Information exchange with the local suppliers in China are communicated via the CSO, as mentioned earlier in the cases descriptions. Information exchange to these suppliers are project based, as presented in the figure below.

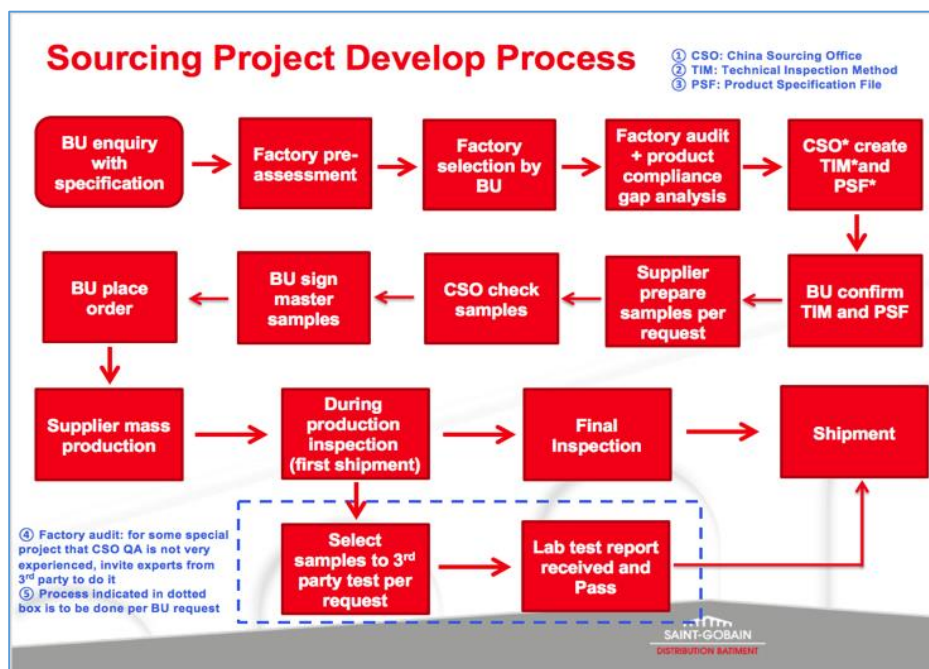


Figure 9. Projects follow-up process - local suppliers via CSO

As illustrated in figure 9, there is a relatively broad range of information being exchanged between BD Vietnam and CSO. It also reveals the large amount of information that needs to be exchanged back and forth between BD Vietnam and CSO. It should be noted that the link of direct exchange with the local suppliers seems to be neglected. However, BD Vietnam stated that there are frame agreements with some of these suppliers, so the CSO is simply doing the quality check, at the same time look for other potential suppliers.

...they have the portfolios, but we know the suppliers. The final decision making is done by us. They are out searching for suppliers and sending the quotations to us, and then we make the final decision of where to buy and what to buy... for several of these pipes suppliers and fittings and stuff like that, we have frame agreements with all of these manufacturers, so we don't have to source a lot every time... (BD Vietnam's general manager, personal communication, January 14th, 2016)

These statements can be used to argue that BD Vietnam lacks a direct contact and information exchange with local suppliers. Clearly, the frame agreements together with the detailed follow-up process of the projects performed by CSO enable BD Vietnam to remain in control of the local suppliers while utilizing the resources provided by CSO. However, BD Vietnam also admits that the indirect communication with suppliers does bring some troubles to the company.

We have to instruct them [the CSO]...we have had a couple of incidents when we received pipes, which was good enough according to the standards, but according to our customers and our demands, it was not good enough. So we have now arranged for better quality check with pictures and movies about inside and outside of the pipes...they are performing it, but we are saying yes or no. (BD Vietnam's general manager, personal communication, January 14th, 2016)

BD Vietnam is also experiencing problems with the delivery time from the local suppliers themselves. "the problem with the Chinese suppliers is delivery time. Often the delay for items is due to manufacturer's faults...they say one month then it takes three months..." (BD Vietnam's general manager, personal communication, January 14th, 2016). During the communication with the local suppliers, the CSO is always in the middle. From the CSO's point of view, there are also challenges in regard to their middle role in the communication process with BD Vietnam. These problems are the lack of clear specifications, short notice of quantity change (or estimated delivery time being brought forward) and the misalignment of inspection requirements between CSO and BD Group in general (CSO, personal communication, April 26th, 2016).

It can be seen that these challenges are all derived from the current communication/information exchange between the two parties. It is assumed that the information is exchanged based on projects, so the frequency of exchange is unstable. Additionally, this illustrates that the exchanged information from BD Vietnam has not yet fit CSO's needs, especially in terms of requirements for quality check. Also, information is exchanged mostly via emails, based on enquiries from either parties. Thus, the level of accessibility for information in general is not high. All these characteristics indicate that the quality of information exchange between BD Vietnam and its local suppliers, via CSO, is not high. This is argued to be the main reason for the challenges in the relationship between the two parties, as mentioned above.

2.1.2 Information sharing with customers

- Information sharing with VARD

Inventory status and items' status are the information that are exchanged the most intensively through each project. Inventory status cover the inventory level of items listed in the frame agreement, as well as items that VARD keeps in BD Vietnam's warehouse. Items' status includes information of items that needs to be ordered from sub-suppliers, and the lead-time for such items.

We have good knowledge about what they have in stocks or not, because we are informed by them. We are not in their data warehouse, but we are informed by their purchase manager about what they have in stocks and what they need, etc. For items that we need to keep on stock here, we know their status there [at VARD's warehouse]...(BD Vietnam's general manager, personal communication, January 14th, 2016).

Sales data are not exchanged unless there is a special request from either side, according to BD Vietnam's general manager. However, VARD confirms that sales data from the company, for future projects, are exchanged with BD Vietnam after the contract for new project is signed (VARD's purchasing manager, personal communication, May 4th, 2016). Order status for tracking and tracing is exchanged between the two companies, and delivery information is sent from BD Vietnam to VARD once the entire package is delivered.

As can be seen, information covering the most important phases of a project is exchanged between the two companies. Clearly, it can be argued that the the exchanged information is relevant for the projects. The two companies do not share a common warehouse, however the frequency of information exchanged during a project is high: "We have very frequent meetings...we talk together may two, three times a week..." (VARD's sourcing manager, personal communication, January 14th, 2016). Based on these statements and the definitions suggested earlier in the literature review, it can be concluded that the information exchanged between BD Vietnam and VARD are of high quality.

- Information sharing with other customers

Based on the data given by BD Vietnam's general manager (personal communication, April 28th, 2016), it appears that information shared with other customers is not as broad and extensive as the information shared with VARD. Accordingly, inventory level is only shared with VARD, but level of stocks for requested items can be shared with other customers on requests. This is similar to sales data, both from BD Vietnam's side and from the customer's side. Production status is not shared between BD Vietnam and other customers. Regarding

order status for tracking and tracing, BD Vietnam usually inform customers of the estimated time of arrival (ETA). In case of delays, BD Vietnam track and trace the orders themselves and then provide information to the customers about the locations as well as the expected new arrival time of the orders.

From the customer’s side, DAMEN Songcam confirms that the company only share information about the items that are supplied by BD Vietnam (DAMEN Songcam’s sourcing manager, personal communication, March 23rd, 2016). For Niigata Shipyard, BD Vietnam’s designated employee for Niigata projects stated “We follow up the project based on the customer’s ENQs [enquiries]” (personal communication, April 19th, 2016). This statement confirms the practice of information sharing only on request, though it does not directly point out the types of shared information. It can however be assumed that only projects related information are exchanged in this case.

Table 7 summarizes the level of information sharing between BD Vietnam and VARD, compared to the level of information sharing between BD Vietnam and other customers.

Table 7

Types Of Shared Information Between BD Vietnam And Customers

Types of shared information	VARD Vungtau	Other customers
Inventory level	Exchanged	Exchanged on requests
Sales data	Shared after a new contract is signed (from VARD)	Exchanged on requests
Order status (from BD Vietnam)	Exchanged	Inform ETA
Production status (from BD Vietnam)	Exchanged	Not exchanged
Delivery status (from BD Vietnam)	Exchanged	Exchanged

Summaries in table 7 once again confirm the fact that information shared between BD Vietnam and VARD is significantly broader and more intensive than that being shared between BD Vietnam and other customers. As can be seen, information shared with other customers is limited in terms of both accessibility (exchanged on requests compared to exchange) as well as availability. Thus, it can be concluded that the quality of information shared with other customers can be considered lower than the quality of shared information between BD Vietnam and VARD.

2.1.3 Methods of information sharing

Emails, phone calls and personal meetings are used as the method of information exchanged between BD Vietnam and its customers as well as suppliers. Among these methods, personal meetings between VARD and BD Vietnam are confirmed to be arranged relatively often (two to three times per week during a project). Personal meetings are also arranged a few times per years with DAMEN Songcam as well as other DAMEN partnering shipyards in Vietnam. According to VARD's sourcing manager (personal communication, January 14th, 2016), this is an efficient information sharing method, and the long relationship between the two companies allow them to always "sit down and discuss before a project", together with extensive sharing of information as mentioned above. This is not a strategy that VARD apply with other suppliers. Additionally, emails are used in case of changes during the projects with VARD.

Emails and phone calls are the most commonly used tool for communicating between BD Vietnam and its partners. There are no data regarding the frequency of emails and phone calls. However, these two method of communication are considered efficient and effective by both BD Vietnam themselves and its customers, as well as suppliers. Particularly, DAMEN Songcam's sourcing manager expressed the satisfaction in communication process with BD Vietnam as "what we are doing now, by phone calls and emails, is working fine. The communication is good. Also, the local people who is working in Vungtau, they reply quite fast, so overall it is good" (personal communication, March 23rd, 2016).

Among all partners, only BD Vietnam and BD Norway are sharing the same information system (M3 system), while other customers and suppliers all use different systems. When asking about the possibility of integrating their information system with customers, BD Vietnam's general manager stated the difficulties in protecting some confidential information such as purchasing prices, selling prices, etc., once the customers are allowed in the system as well.

Additionally, besides these technical issues, BD Vietnam's general manger stressed the lack of requirements from industrial customers as the bigger reason for the current mismatch in information systems among partners (personal communication, March 11th, 2016).

In order to understand the lack of integrated information system between the two companies, one can trace back to discuss some of the drawbacks of EDI and how it can be seen in this case of BD Vietnam and its collaboration partners.

- Since EDI is designed as for all companies in one-fits-all spirit, it may not meet the exact needs of a supply chain

The customers' outputs are ETO and project driven products. Thus, it can be understood that the company might require a special enterprise system to cater the high level of customization. BD Vietnam, on the other hand, works with standard items with relatively lower level of customization than its customers' final products, thus a less sophisticated enterprise system might already fit the needs of the company. Thus, for the partners to integrate its information system, it is very likely that BD Vietnam might have to pay more for the system that is not necessary and over-complicated for its needs.

- EDI is designed primarily for transaction processing, especially around purchase orders and invoices, thus it has severe limitation for information sharing;

The collaboration between BD Vietnam and its partners involves more than the exchange of simple transaction information. For example, BD Vietnam and VARD collaborate quite extensively in the early phase of engineering; BD Vietnam also needs to exchange extensive amount of technical-related information to the Saint Gobain CSO; to some customers such as Niigata, Kawasaki, or Triyards, there are also a large amount of technical drawings and information that need to be exchanged back and forth, specifically in the bidding process. At the same time, changes and customization is to be expected in the shipbuilding industry. These facts indicate a significant level of information exchange regarding knowledge and expertise, which are usually considered confidential and valuable assets for companies. It is assumed that the available inter-organizational systems have not been able to completely support the exchange of such information.

- External pressure

It is stated that companies are more likely to adopt EDI if more trading partners, and their competitors, become EDI-capable. In this case, BD Vietnam also confirmed that an integrated information system has not been a part of the development plan so far, mainly due to lack of pressure, yet, from their customers. However, the company has also been informed about VARD Group's potential adoption of a new enterprise system, which BD Group might be asked to integrated with. BD Vietnam will then consider joining the system if this should happen. DAMEN Group in Vietnam also approach this issue by stating the connection between a common information system and future relationship development between the two companies: "In the future, when the volume is really going up, much more than what we are doing now, I think then there is much more to see or to discuss of what is

possible...” (DAMEN Songcam’s sourcing manager, personal communication, March 23rd, 2016).

2.1.4. Summary of information sharing in BD Vietnam

Information exchange practices in BD Vietnam is characterized by selective broad information sharing with the company’s main supplier (BD Vietnam) and long term customer (VARD), and limited information sharing with other partners. In terms of information sharing with suppliers, BD Norway is the prioritized partner. Accordingly, shared information between BD Vietnam and this supplier cover not only projects and items related information, but also management and technical knowledge. On the other hand, information shared with the local suppliers are limited and have to be mediated via the Saint Gobain CSO. This indirect communication method appears to bring a number of challenges to both BD Vietnam and the CSO themselves. Thus, it is tentatively concluded that the information shared with BD Vietnam is in higher quality than the information shared with the local suppliers via the Saint Gobain CSO.

Among all the investigated customers in this study, VARD is the prioritized partner in terms of information sharing. Shared information between BD Vietnam and VARD also cover all types of information needed throughout a project, i.e. inventory levels, sales data, order status, production status and delivery status. On the other hand, information shared with other customers does not include production status, while other information types are only exchanged upon requests. Based on this analysis, it is also concluded that the information shared with VARD is of higher quality than the information shared with other customers.

The communication process is also facilitated by simple information exchange methods, which are emails, phone calls and personal meetings. Personal meetings are arranged extensively between BD Vietnam and VARD Vungtau during a project. Emails is the communication method for changes during a project between the two partners. This method and phone calls are also the most used methods for communicating with other customers and suppliers. The common information system is only applied between BD Vietnam and its main supplier BD Norway, due to the mother – daughter company characteristic between these two partners. A discussion of the EDI characteristics suggests the suitability of the current communication method at BD Vietnam, and partly explains the lack of an integrated information system. Accordingly, the operating environment at BD Vietnam, which can follow both MTO and ETO principles, to some extents allow the company to work on a relatively simpler ERP system than its customers, to some extents. Thus, upgrading to a

more complex system, in order to serve the customers, might require BD Vietnam to invest on a system that is more complicated than needed. Secondly, the nature of information exchanged in this case surpasses simple transaction information. It in fact includes a large amount of technical expertise and knowledge, which is assumed yet to be supported by the current available information system, in terms of transferring method. Finally, it appears that the lack of external pressure from industrial customers has a strong influence in BD Vietnam's current unintegrated information system. Approaching this issue, BD Vietnam stated that the company is willing to upgrade the current information system should there be a request from their customer, and a potential request might be coming from VARD soon. DAMEN Songcam, on the other hand, approach the issue via perspective of the future collaboration between the two companies. Accordingly, DAMEN Songcam see the potential in an integrated information system with BD Vietnam once a frame agreement is reached, and the purchasing volume is significantly higher than the current volume. Once this happens, it is assumed that BD Vietnam's communicating practices can be changed.

2.2. Vendor managed inventory in engineer to order supply chain

2.2.1 The applied VMI concept

As mentioned in the cases' descriptions, a concept that is close to VMI is being applied as the collaborative supply chain management between the case company and its long term customer. This concept is also potentially being applied for a new potential customer as well. Thus, it will be interesting to analyze the different aspects of this applied method.

In terms of definition, the applied concept at BD Vietnam fulfills two out of five conditions of a full VMI concept. One can also argue that the first characteristic of a VMI relationship is also fulfilled, even though there are slight differences. Details of the definition and the VMI application in BD Vietnam are as follows:

(It should be noted that in this paper, the definition of VMI is adopted from that provided by Vigtil (2008).)

- *The replenishment decision is in the hands of the supplier, both with respect to frequency, volume and time.*

In the case of BD Vietnam and VARD, the replenishment decision is in the hand of both the customer and the supplier. For items that are listed in the frame agreement, the replenishment decision is in the hands of BD Vietnam. Additionally, VARD also stores some items outside of the frame agreement at BD Vietnam's warehouse. These items are also replenished by BD Vietnam based on the updated information of the items' inventory status at VARD warehouse or workshops. For specialized items, the replenishment decision is initiated by VARD based on each project, and BD Vietnam proceeds the order accordingly.

- *Supplier's replenishment freedom is limited to preset performance standards, these could be max/min inventory levels, reorder point agreements, inventory turnover measures, required service levels and others.*

BD Vietnam and VARD work based on a frame agreement, which states that BD Vietnam should always have one ship set of standard equipment available for VARD to purchase at any time.

- *Some sort of demand information is transferred from the customer to the supplier, frequency and format of information exchange may differ, as do type of demand information.*

Information exchanged between the two companies covers most phases of a project, which includes: inventory level, sales data, order status, and delivery status.

- *There are no customer orders initiating a purchase, stock withdrawals are made by customer on demand and related invoice is issued periodically or by activity.*

Purchasing orders are still needed for the purchase of items not listed in the frame agreement. For items in the frame agreement, a purchase order is also needed before stock withdrawal. However, as BD Vietnam is practically VARD's second warehouse, there are cases that the purchase orders are sent but the items stay in BD warehouse until VARD needs the items at their workshop.

- *The receiving warehouse is owned by the customer or operated by some 3rd party on his behalf. The customer possesses the goods and the supplier is not free to transship goods to other customers.*

The receiving warehouse in this case is owned by the customer, VARD. Items that are listed in the frame agreement (one ship set) are assumed to be VARD's own items, thus it is expected that BD Vietnam is not free to sell such items to other customers, unless the inventory level is higher than the agreed one ship set. It should also be noted that the items in the frame agreement are standard items which can be used for similar projects. Thus, should there be redundant items after one project is finished, they can be reused in the next project.

Based on the above analysis of the applied collaborative supply chain method at BD Vietnam, it can be tentatively concluded that this strategy falls into the definition of VMI. Additionally, according to Mattson (2002, as cited in Vigtil, 2008), VMI is defined as the replenishment method where goods' ownership is transferred to the customer upon goods arrival at the warehouse, while in VMI, goods belong to the customer even when it is still in the supplier's warehouse. In this case, there are some of VARD's items that are not listed in the frame agreement, but are still stored in BD Vietnam's warehouse and jointly managed by BD Vietnam. These items belong to VARD regardless of BD Vietnam's involvement in the management process. For items that are listed in the frame agreement, as well as other items ordered by VARD, BD Vietnam can receive the PO and still keep the items in their warehouse until VARD needs it at the workshop. Thus, these items also belong to VARD but are physically and temporarily stored in BD Vietnam's warehouse. Clearly, based on this classification, the method applied at BD Vietnam towards VARD falls into the concept of VMI.

2.2.2. The suitability of VMI collaboration between BD Vietnam and VARD Vungtau

2.2.2.1. Products and supply chain characteristics

In this case, the two companies operate in an industry that is projects-driven with unpredictable demand. Ruuska, Ahola, Martinsuo & Westerholm (2013) referred to the shipbuilding industry as a good example of discontinuous project business. Accordingly, the production of sea vessels generally is organized as extremely large and complex projects, carried out in hundreds of work packages delivered by several external suppliers. Shipbuilding projects often involve a large number of organizational actors that collaborate to deliver a product of high complexity. Along with collaboration based on the joint goal of building a complete ship, these organizations also have their own business goals which can be in conflict with other actors' goals.

In economic terms, the shipbuilding market is known to be dynamic and volatile, and operated with cycles. These cycles are not random fluctuations designed to challenge the shipyards, but are part of the mechanism for adjusting shipbuilding capacity to the changing needs of world trade. In general, production time for a vessel can be a couple of years. Thus, the investor cannot accurately predict the needs for a vessel by the time it is finished. In the absence of believable forecast, market sentiment often takes over. As a result, ordering often peaks at the top of a cycle, but by the time the ships are delivered, the business cycle has already driving down demand and the flood of new ships increase the surplus, thus prolong the downturn. On the supply side, since shipbuilding is a sophisticated engineer to order activity, it is very difficult for shipyards to adjust their output. Thus, shipyards often drop their prices to encourage speculative counter cyclical orders and liquid investors often take advantage of the bargain. The combination of these two characteristics, according to Stopford (2009), tends to slow the market adjustment process, leading to some very long shipbuilding cycles. An illustration of the observable cycles in the shipbuilding market is provided below (Figure 10).

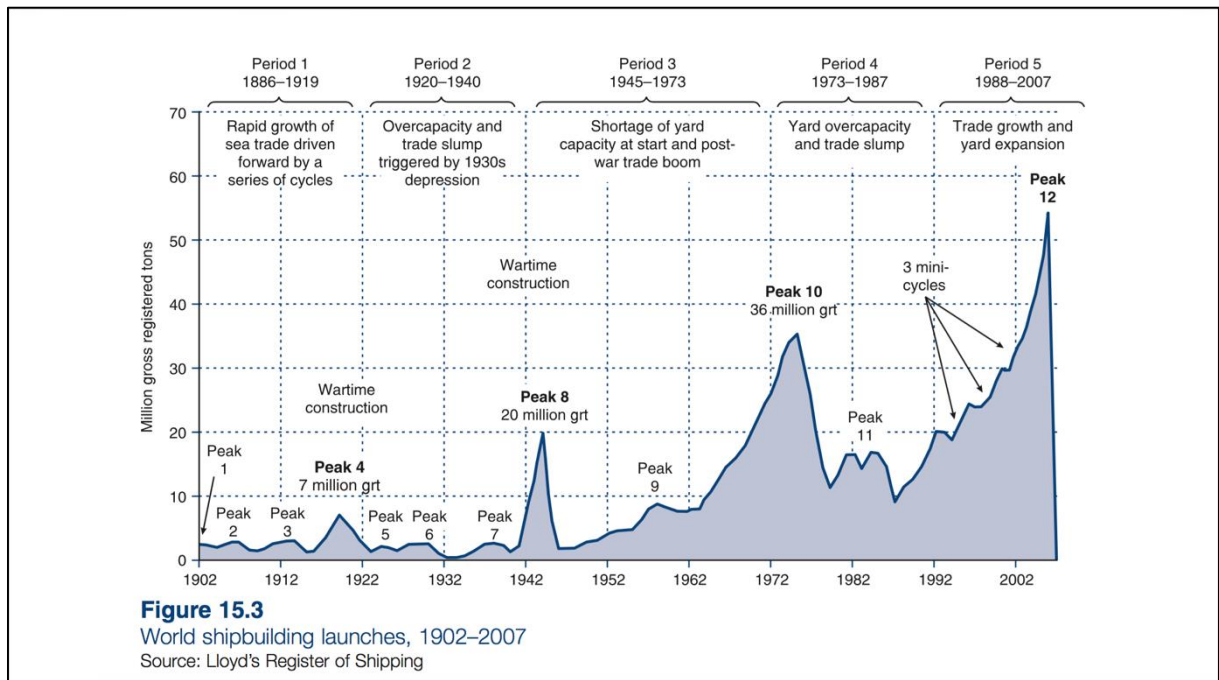


Figure 10. Cycles in the shipbuilding market (adapted from Stopford, 2009).

As can be seen in the above figure, it is logical to conclude that the shipbuilding market is extremely volatile. As stated by Volk (1994, as cited in Stopford, 2009), the industry is characterized by "...heavy fluctuation of demand over the short-term and by the inertia of the supply side. This fact leads to brief phases of prosperity and long phases of depression." In terms of product characteristics, the products BD Vietnam supply to VARD are mostly standard items (pipes, valves and fittings) that count to about 20% of the total purchase in VARD. Compare to other parts of the ship, these are not high technical items that need to be throughout engineered. However, customization should always be expected in the shipbuilding industry, thus, a certain degree of engineering process is required, although not as intensive as other parts of the ship.

The operational characteristics of shipbuilding industry, which is project-driven with extremely customized products, indicate the crucial role of supplier collaboration. It should also be noted that, according to Xu (1996), VMI collaboration is best suited for supply chains with an unstable and fluctuating demand curve, as the main benefit of applying VMI is to increase information visibility which allows manufacturer to improve planning efficiency. Clearly, characteristics of the shipbuilding industry fits relatively well into this category, thus it confirms the suitability of apply VMI in this situation. Additionally, shipbuilding market characteristics further highlights the importance of supplier' involvement and collaboration to shipbuilding companies, which in this case is VARD, in order to work with the deadlines and avoid delays as much as possible, thus being able to reduce the potential

damage resulted from the downturn of business cycles. Given the characteristics of the products supplied by BD Vietnam to VARD, it is logical that a frame agreement is greatly beneficial for both partners. For VARD, a frame agreement secures the supply of standard items, so it can spend time and effort on items that require higher level of engineering. For BD Vietnam, it secures a significant sales proportion with an opportunity to work and learn from the collaboration as well. In this case, the frame agreement between the two companies is the result of a long collaboration history and a high level of trust, which is discussed in the next part of the paper.

2.2.2.2. Trust

Representatives from both companies confirmed the role of mutual trust in this relationship. The collaborative strategy was initiated mainly due to the long term relationship between VARD Group and BD Group in Norway. As mentioned previously, the establishment of BD Vietnam as well as the idea of BD Vietnam being a second warehouse for VARD in Vietnam was initiated by VARD. However, that statement that BD Vietnam will be the warehouse for VARD redundant items is not a part of the frame agreement, but rather an informal mutual agreement between the two companies. Clearly, by agreeing upon this condition, BD Vietnam took on itself the risk of not having enough space for other customers' stock in the warehouse, thus making it difficult to reach out for other customers, should VARD's business have a down period. The fact that BD Vietnam agreed upon this condition and continuously working with this informal promise shows significant level of trust in VARD. In return, BD's consistency in keeping service level not only according to the frame agreement but also informal agreement increase VARD's trust in BD Vietnam as well.

Windeler & Sydow (2001) stated that a long history of working together creates the shared understanding of task requirements. This can be considered an important ground for further and closer collaboration, which can be argued as one factor that lead to trust development. In this case, the long collaboration history between BD Group and VARD Group in general and between BD Vietnam and VARD Vungtau in particular, can be seen as one of the factor help developing trust level gradually to the current level, which is confirmed by both companies, as a win-win relationship.

Extensive personal meetings and information exchange between the two companies during project processes also indicate the development of mutual trust and understanding between two partners. This type of arrangement, as stated by Kadefors (2004), has significant role in increasing the trust level between partners. According to the author, project-wide

communication in the early phase is found to influence the participants' behavior and general knowledge, so that trust-based collaboration is more likely to arise and persist.

2.2.2.3. Areas of collaboration

In this case, the two companies established a joint force in inventory management, production and design (engineering) processes. Joint inventory management is carried out with extensive information sharing regarding inventory level (from both BD Vietnam's warehouse and VARD's warehouse). BD Vietnam is also taking part in the engineering process of some technical items. Regarding the production process, BD Vietnam provides VARD with detailed information regarding the status of items needed throughout each project, thus it allows VARD to schedule the production plan accordingly. The two companies also have plan for a warehouse management knowledge sharing program, however the actual implementation of the program is delayed due to the current costs cutting strategies from VARD. There is no joint collaboration in forecast or sales. The lack of collaboration in these two areas can be due to the market characteristics of shipbuilding industry, which, as discussed in the previous part, is said to be strongly project driven and significantly unpredictable with a lot of ups and downs.

2.3. Joint force arrangement between BD Vietnam and BD Norway

As discussed earlier in the study, a joint force arrangement between BD Vietnam and BD Norway has been the goal since the establishment of BD Vietnam. However, before late 2014, this arrangement was only applied for VARD Vungtau. After successfully securing a contract with Niigata Shipyards in September 2014 using this joint force, the model has been applied to other customers including DAMEN, Kawasaki and Triyards. BD Vietnam also stated that the company is looking to use more of this model in the future (BD Vietnam's general manager, personal communication, January 14th, 2016).

The core strategy of this model lies in the collaboration of BD Vietnam and BD Norway in presenting a complete package to customers. This model requires joint collaboration from BD Vietnam and BD Norway from the bidding process until delivery is finished. In the bidding process, a large amount of technical information and drawing is required from the customers. To solve this, employees from both BD Vietnam and BD Norway work together to produce one complete answer, usually in forms of technical drawings, to send to the customers directly from the common BD Group server. After the contract is secured and throughout the entire projects, information about the items are communicated directly between the customer and the supplier responsible for the items, although all actors participate in the information exchange. Additionally, all communication from both BD Vietnam and BD Norway to the local suppliers are through the Saint Gobain sourcing office in China. In terms of logistics arrangement, the items are also shipped directly from either Vietnam or Norway to the customer.

Figure 11 describes the model's practices in terms of both information and goods exchange among BD Vietnam, BD Norway, local suppliers and the customers during a project. It should be noted that the communication processes are mostly facilitated by exchange of emails, with the exception of some phone calls.

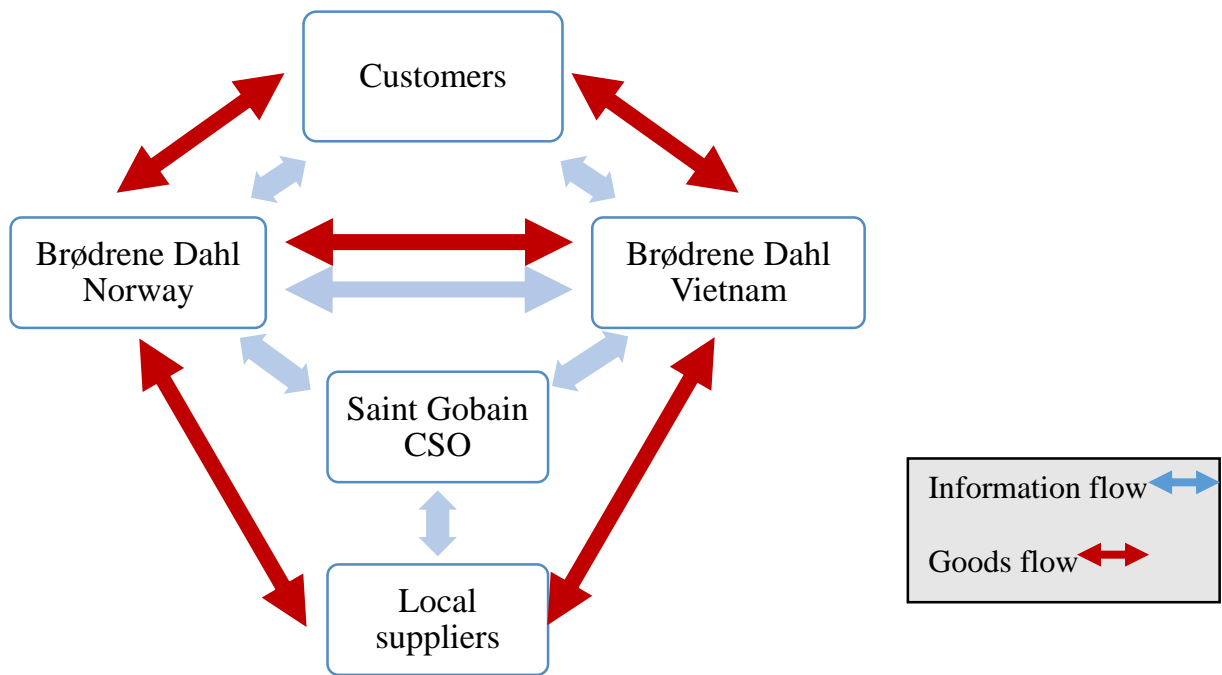


Figure 11. Information and good exchange in the joint force model at BD Vietnam

As explained in the previous part regarding the joint force between BD Vietnam and BD Norway, each partner's responsibility is mentioned clearly to the customer in the beginning of every project. After the project starts, communication goes directly from the customer to either BD Norway or BD Vietnam, depending on the items. BD Norway is usually responsible for high-tech items, and standard items are taken care of by BD Vietnam. In this case, BD Vietnam and BD Norway each has one designated employee to be responsible for the joint force and follow-up each project accordingly. The communication to and from the customers, however, is managed so that both members of the joint force and the customers are always kept on the topic and none of the information are missed out.

This joint force arrangement can be analyzed and understood using the concepts of vertical integration and resources combination. First of all, in terms of vertical integration, BD Vietnam in this case has integrated BD Norway, as the main supplier, into its business model by utilizing the technical expertise of the supplier. It is assumed that, without this joint force arrangement, BD Vietnam will have to order the high-tech items separately from BD Norway, then combine them with the items purchased from local suppliers, and approach the customers on its own. With this integration, BD Vietnam is able to be get BD Norway involved in the earlier phases of approaching customers. Additionally, BD Vietnam's general manager once stated that BD Vietnam is still dependent on BD Norway in technical advice (personal communication, March 11th, 2016). Thus, this integration allow BD Vietnam to be more active in utilizing BD Norway's technical expertise, which is considered

an important resource in this case. According to Hicks et al. (2000), vertical integration can also increase the scope of concurrent engineering and the flexibility to deal with design changes. For BD Vietnam, a company that works mostly in the ETO environment, increasing flexibility is a significant competitive advantage, which can be argued to be achieved via the joint force with BD Norway. An illustration of this vertical integration is presented in figure 12.

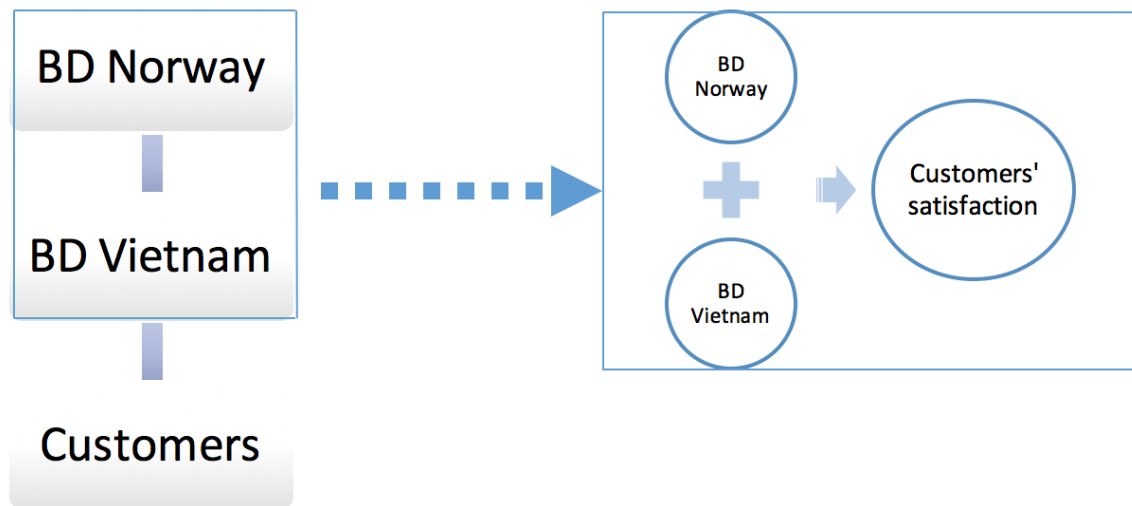


Figure 12. The joint force practice between BD Vietnam and BD Norway

The joint force arrangement can also be analyzed using the resource combining theories. In this case, the combined resources include facilities and organizational units, based on the 4R model introduced by Håkansson and Waluszewski (2002). Accordingly, in the bidding process, BD Vietnam and BD Norway join force in creating the complete technical drawings and send them to the customers using the same server. It should also be noted that BD Vietnam also orders standard items from BD Norway in some cases, according to BD Vietnam's employee: "In some case if BDN [BD Norway] have material in stock, we arrange material to ship from BD Norway by air freight to meet customer's requirement." (personal communication, April 12th, 2016). BD Vietnam's general manager also confirms that the company receive one 20-foot container with items from BD Norway per month (personal communication, March 11th, 2016). These statement clearly confirms the benefits that BD Vietnam gain from accessing the facilities resources at BD Norway.

Additionally, technical expertise is an important resource from BD Norway that BD Vietnam can access via this arrangement. Via the joint force, BD Vietnam is able to utilize this intangible resource, which is classified as organizational unit resource, from BD Norway, and use that to approach the customers. As mentioned earlier in the analysis regarding resource combination in general, this joint force allows BD Vietnam to approach

customers in the region with a Norwegian brand, which according to the company, is the door opener to many customers in the South East Asia region. BD Vietnam also considers this benefit as the biggest benefits of the joint force, as the physical goods remain being shipped directly from either BD Vietnam or BD Norway to the customers. This logistical arrangement is believed to be the reason why BD Vietnam did not state any significant costs improvement gained through the arrangement.

3. *The collaborative patterns*

This part of the paper utilizes Derrouiche et al. (2008)'s collaborative model, in order to analyze the collaborative practices being applied at BD Vietnam. The model focuses on four areas of collaboration, each of which are divided into different level. Details of the focused areas are presented in table 8.

Table 8

Areas Of Focus In Collaborative Model (adapted from Derrouiche et al. (2008)).

Area	Level 1	Level 2	Level 3	Level 4	Level 5
Extend of the collaboration	Intra-enterprise	Inter-enterprise: Bi-levels	Inter-enterprise: Multi-levels	N/A	N/A
Context the collaboration	Data	Information	Knowledge	Expertise	Capability
Nature of the collaboration	Make objects available	Exchange	Share	N/A	N/A
Level of decision	Operational	Tactical	Strategic	N/A	N/A

Notes. N/A means not available.

Based on this classification, analyses of the collaborative patterns between BD Vietnam and its customers as well as suppliers were conducted. By comparing the shapes of the cartographies, one can observe the differences between the collaborative strategies being applied in the case company (Derrouiche et al., 2008). The collaborative strategies were analyzed based on sectors, including both suppliers and customer sectors. In each case, a MAX curve, which represent the optimal collaborative practices, was included. The cartographies are presented below in figure 13 and 14.

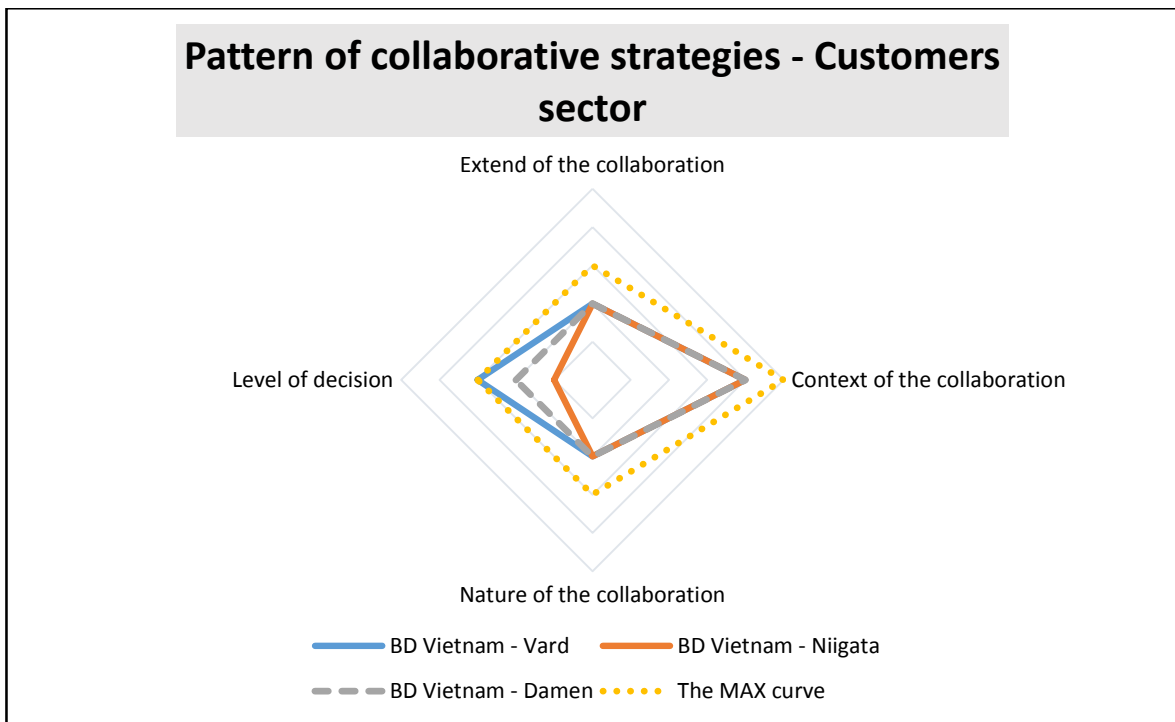


Figure 13. Collaborative patterns - Customer sectors

Different shapes of the above cartographies indicate clear differences in collaborative strategies between BD Vietnam and each of its customers. There are, however, a common collaborative pattern between BD Vietnam and its customers in terms of the extent, context and nature of the collaboration. The current collaboration between BD Vietnam and each of its customers does not involve the entire supply chains at both sides. Thus, the extent of the collaboration is only at Bi-levels of inter-enterprise integration. The characteristics of the shipping industry and its ETO environment requires BD Vietnam to always provide customers with technical knowledge and expertise, thus it is concluded that the context of collaboration between the company and its customers is at expertise level. Information are exchanged quite extensively between BD Vietnam and its customers, especially to VARD Vungtau. However, an integrated performance system has not been used. Thus, the nature of collaboration remains at exchanging rather than sharing, as there has not been any common development or using of data by the two companies. The level of decision, however, is observed to be at optimal level for the collaboration between BD Vietnam and VARD Vungtau only, due to the trusts built up from a long term partnership. This area of collaboration between BD Vietnam and Niigata is observed to be at operational level only, while the collaboration with DAMEN is currently at operational level, with the potential to reach strategy level once the frame agreement can be obtained.

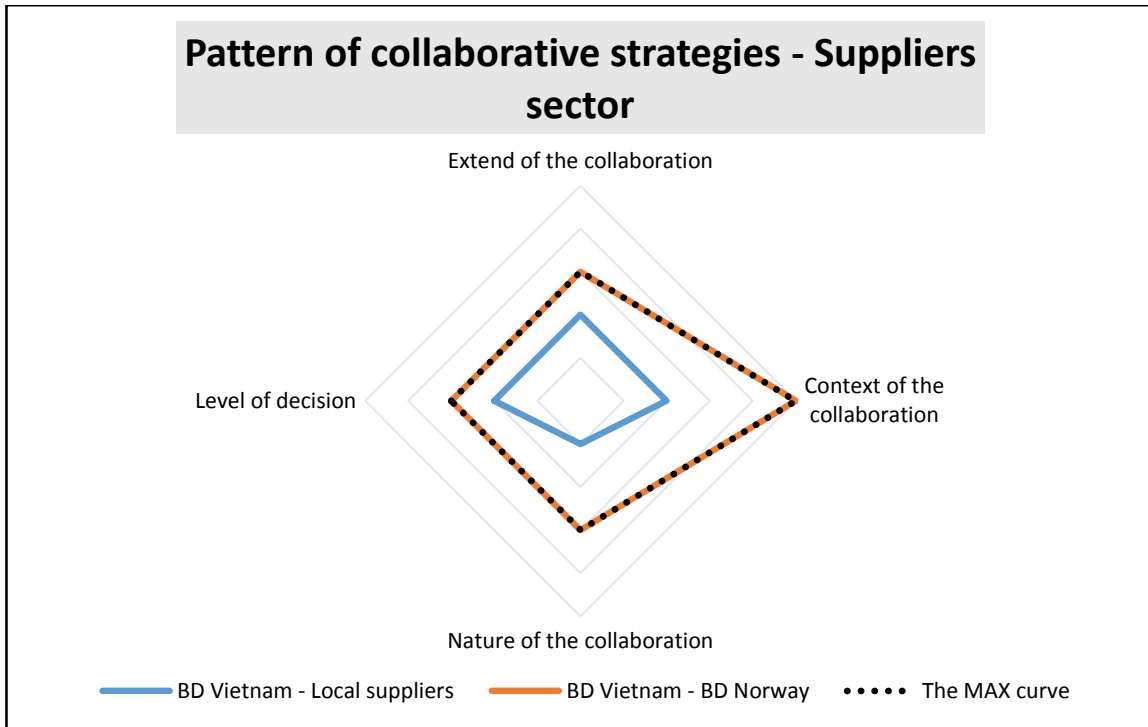


Figure 14. Collaborative patterns - Suppliers sector

The above catergraphies show significant differences in the collaborative patterns between BD Vietnam and BD Norway, and between BD Vietnam and its local suppliers (Fig.14). As BD Vietnam is the daughter company of BD Norway, it is understandable that the collaboration between the two companies is at high level. In this case, the two companies technically share a common suppliers system, especially the local suppliers in the Asia region which is managed by the Saint Gobain sourcing office. It is assumed that BD Vietnam can also use other European suppliers in BD Norway’s system. Thus, this can be considered a complete and multi-level of inter-enterprise integration. The two companies also share a common information platform for operational information exchange, while management knowledge is also transferred from the mother company to the daughter company. Thus, the context of collaboration as well as the nature of collaboration is observed to be at high level. Regarding decision level, it is confirmed that BD Vietnam is operating independently from its mother company. However, the joint force between the two companies, which was analyzed earlier, indicate a certain level of common strategy development between the two companies. Thus, this area of collaboration between BD Vietnam and BD Norway is also at high level.

The collaboration between BD Vietnam and its local suppliers, however, is significantly less optimal than the collaboration with BD Norway. First of all, it should be noted that collaboration between BD Vietnam and the local suppliers is relatively indirect, especially

in terms of information exchange. Besides the direct shipments of physical goods from the suppliers to BD Vietnam, the rest of the collaboration appears to be mediated through the CSO. Nevertheless, the level of collaboration is only at bi-levels of inter-enterprise integration, as this arm-length relationship does enable either BD Vietnam or the local suppliers to get involved in each other's entire supply chain. The context of collaboration is at knowledge level, as BD Vietnam only exchanges items related information in terms of specification, delivery dates, or required changes. There is no information that can be used to analyze the nature of collaboration in this case. However, it is assumed that the local suppliers provide BD Vietnam with necessary data when required, and there might be an unequal amount of data from BD Vietnam that are acquired by the suppliers. Thus, the nature of collaboration in this case is set at make available level, with favor in BD Vietnam's side. Finally, the decision level in this case is only at tactical level, with regards to decisions such as forecasting, scheduling or ordering of short time materials.

The above analyses reveal certain collaborative patterns between BD Vietnam and its partners. It is shown that there are room for collaboration improvements in both sectors. Between the two sector, there are more common shapes of the collaborative patterns between BD Vietnam and its customers, which indicates relatively similar strategies applied for the customers. The only differences in collaborative patterns in this sector is in the decision level, in which BD Vietnam only share the strategic decision with one out of three investigated customers. The difference is argued to be based on the level of trust between BD Vietnam and the customers, caused by the longevity of the relationship, as well as the states of future development. The collaborative patterns between BD Vietnam and its suppliers, however, reveal significant difference in collaborative strategies. BD Vietnam and BD Norway, as being the mother and daughter company, appear to apply collaborative practices at optimal level. BD Vietnam and its local suppliers, on the other hand, collaborate at limited level. The differences in suppliers collaborative strategies at BD Vietnam indicates the application of suppliers differentiation or supplier segmentation practices, which has been discussed in a large amount of literature (Kraljic, 1983; Dyer, Cho & Chu, 1998; van Weele, 2010; Lambert, 2014).

Conclusions

This study presented a number of analyses regarding the issues of collaboration practices at a company who supplies standard parts to a number of shipbuilding companies located in South East Asia. The paper approached these issues via studying the business relationships between the case company and a number of its partners, including both suppliers and customers. Findings from these analyses were summarized and presented below as answers to the research questions earlier proposed in this study. Based on this summary, a number of theoretical and practical contributions were suggested. Finally, a short discussion regarding the limit of the paper, together with recommendations for further studies were presented at the end of this study.

1. Collaboration practices at BD Vietnam

In the beginning of the paper, a research question was raised, which concerns the characteristics of the supply chain collaboration at BD Vietnam. The exact question is as follows:

Research question: *What characterizes the supply chain collaboration at the case company (Brødrene Dahl Vietnam)?*

Findings from the multiple analyses reveal a number of collaboration strategies being applied in this company, as shown through its different business relationships. First of all, it can be concluded that these relationships between BD Vietnam and its partners are strongly characterized by the utilization of resources combination. The combination of resources between BD Vietnam and its owner group Saint Gobain can be seen in various aspects. Among all, the usage of Saint Gobain CSO office for local supplier management can be argued to be the most beneficial for BD Vietnam, given Saint Gobain's broad network and the concentration of supplier management resources in this office. Resource combination can also be seen via the joint force between BD Vietnam and its main supplier BD Norway, especially in terms of technical expert utilization. Finally, resource combination is clearly shown through BD Vietnam's ability to learn from its long term business relationship with VARD. It is concluded that BD Vietnam was able to take advantage of the good business model between itself and VARD, and apply it to other customers as well.

Findings from the study also indicate the possibility to apply a VMI strategy to the supplying process for standard items in the shipbuilding industry, despite the influence of the ETO

environment. The VMI strategy currently being applied between the case company and one of its customers appears to be customized in order to fit into the ETO environment of the shipbuilding industry. This VMI strategy is facilitated by high level of trust built through a long term relationship, not only between the two companies, but also between the two groups that the companies belong to. Additionally, the VMI strategy in this case is characterized and possibly enabled by the unofficial warehouse service agreement between the two company, in which the case company offers its warehouse as the secondary warehouse for its customer. It is argued that this arrangement is the facilitator for the extensive information exchange between the two companies regarding inventory level, which forms the base of the VMI relationship.

Information exchange in BD Vietnam is another studied aspect of collaboration. Findings from the study show broad but rather selective information sharing activities between BD Vietnam and its partners. Accordingly, information is shared extensively between BD Vietnam and its main supplier BD Norway, as well as to the main customer VARD Vungtau. Nevertheless, information shared to the local suppliers as well as other customers do not reach a similar level. Information sharing in the case company is also facilitated by non high-tech information technology. It is argued that this method of information sharing is suitable for the current business situations at BD Vietnam.

To further understand the nature of collaborative practices at BD Vietnam, the three subquestions were also answered. Discussions based on these questions had further unveiled the picture of collaboration at BD Vietnam. The questions and answered are presented below.

Sub-question 1: *What is the characteristics of business relationships between the case company and its suppliers?*

The relationship between BD Vietnam and BD Norway, according to the model applied in this paper, is at optimal level for all areas of collaboration. The collaborative strategies with the local suppliers, on the other hand, appear to be at low level. This is argued to be caused by BD Vietnam suppliers segmentation strategies, that allows the company to have its local suppliers to be managed by a third party organization, which is the Saint Gobain CSO. This rather indirect relationship leads to the low level of collaboration between the BD Vietnam and the local suppliers, which are assumed to be the cause of a number of problems discussed earlier.

Sub-question 2: *What is the characteristics of business relationships between the case company and its customers?*

There are certain commonalities in collaborative strategies between BD Vietnam and the three investigated customers, which in this case are the three current biggest customers of the company. However, only with its long term customer VARD that the collaborative practices applied by BD Vietnam is almost at optimal level. This is argued to be caused by the long collaboration history that leads to higher level of trust between the two companies, compared to the relationship between BD Vietnam and the other two customers.

Sub-question 3: *Can a best practice be found in one or more of the relationships, and to what extend can this mode of relationship management be applicable for the development of other business relationships?*

As discussed earlier, the relationship model between BD Vietnam and VARD is argued to be the best practice at the moment. BD Vietnam also confirms that extending this model has been the goal since the establishment of the company. However due to some external and internal issues, as discussed earlier, the model has not been reapplied until late 2014. This model is currently being applied to more than one customers, and the company is looking to further extending it, in the form of the joint force arrangement between BD Vietnam and BD Norway. It appears that to a large extend, the model can be applied to many other customers rather than VARD. However, for BD Vietnam and other customers to reach the current level of relationship as it is between BD Vietnam and VARD, trust is a crucial element that is not easy to built in a short time. There is also drawback in this model, which is the additional warehouse service supplied by BD Vietnam. BD Vietnam is offering this service to DAMEN Songcam, thus it appears that the company is trying to utilize the knowledge obtained through being a warehouse to VARD, for this customer. However, this strategy implies a limitation in physical resources, as BD Vietnam cannot offer the service to all suppliers, or this might not be required by all customers. The model, therefore, should only be applied to the extend of a resource combination strategy between BD Vietnam and BD Norway, to serve and response to customers in a fast and flexible approach.

2. Contributions

2.1. Theoretical contributions

The theoretical contributions presented in this section are derived from findings of the different case studies in the thesis. It can be concluded that these theories are relatively valid and reliable, due to a number of techniques which had been applied during the entire research process. Details of the applied validity and reliability techniques can be found in the methodology part presented previously in this thesis.

2.1.1. VMI strategy in an ETO supply chain

As mentioned earlier, Xu (1996) suggested that VMI collaboration suits the best for supply chains with unstable or fluctuate demand curves, as the main purpose of this collaboration method is to improve the information flow and consequently reduce fluctuation of the demand curves. In this case, the VMI collaboration applied at BD Vietnam functions significantly well, and it does bring various benefits for both partners in terms of dealing with the unpredictable demand. Clearly, these findings support Xu (1996)'s statement regarding the suitable supply chains for the application of VMI collaboration. However, it should be noted that in this case, the VMI collaboration was facilitated by an additional warehouse service offered by the case company to its customer. It is believed that, beside the high level of mutual trust and a long term business relationship, this additional service plays a critical roles in forming the VMI practices between BD Vietnam and the customer VARD Vungtau. In short, this study supports Xu (1996)'s statement and suggests the possibility of a VMI collaboration in supplying standard parts within an ETO supply chain, with the facilitation of an added service.

2.1.2. ETO supply chain and integrated information systems

As shown and discussed in this study, most of the information exchanged between the case company and its partners are facilitated by simple methods such as emails, phone calls, and personal meetings. Despite concerns over the lack of an intergrated information system, the study shows a considerably high level of customers' satisfaction regarding the application of the simple information exchange methods. It was also argued that the lack of an intergrated information system is understandable and acceptable in this particular supply chain, due to the special ETO operating environment of the focal company as well as its partners. These arguments lead to a tentative suggestion regarding the possibility of good

supply chain coordination despite the lack of an integrated information system between all partners. These findings are in line with the statement made by Mattson (2002) that suggests the possibility of an VMI relationship facilitated by manual information exchange. Additionally, findings in this study confirms the role of external pressure in the company's willingness and readiness to adopt EDI, which was previously discussed by Iacovou (1995).

2.2. Practical contributions

2.2.1. Better focus on local suppliers

The collaborative patterns presented in this paper reveals a significantly low level of collaboration between BD Vietnam and its local suppliers, compared to other partners in the network. It is understood that BD Vietnam benefits greatly from the Saint Gobain's supplier management team. Nevertheless, this indirect management also appears to cause certain problems for BD Vietnam's businesses. Thus, it is recommended that BD Vietnam pays more attention to the local management activities. These changes can be done through getting more involved in the CSO's activities, as well as increasing direct contacts with local suppliers if possible. These suppliers and the Saint Gobain CSO play a crucial role in BD Vietnam's supply chain. Therefore, it is believed that a better local management strategy can greatly benefit the case company in terms of reducing leadtime as well as ensuring the desired quality of the products.

2.2.2. Intergrated information system

As mentioned earlier, findings from this study indicate the possibility of a well coordinated ETO supply chain, despite the lack of an integrated information system. The paper also provided a number of argument for the suitability of applying simple information exchange methods in this supply chain. These argurments concern the content of information being exchanged to the customers, in comparison to the information exchanged internally as well as to the suppliers. On one hand, the required information from BD Vietnam's customers can be highly technical or confidential, given the characteristics of the shipbuilding industry. On the other hand, BD Vietnam's own products are standard items, thus it is assumed that the type of information exchanged internally and to its suppliers is significantly less complicated than the information sent to the customers. These contrasting characteristics raise the concern of BD Vietnam, over the potential pressures from its customers, having to use an integrated informaton system that are more complicated than needed. Naturally, it is

assumed that the more complicated a system is, the more expensive it is. It is therefore recommended that BD Vietnam takes these arguments into consideration before deciding to integrate its information system with any of its customers.

3. Further researches

As mentioned in the theoretical contributions, findings from this study are supported by earlier studies in either similar or broader fields of study. Additionally, a number of techniques were applied in the paper, in order to ensure validity and reliability of the study. Nevertheless, this study's samples remain within a limited number of business relationships within a single supply chain. The findings therefore might be applicable for this particular case only. It is therefore suggested that a similar study with samples from more than one supply chains, which are similar to BD Vietnam's supply chain, is to be carried out, so that the results can be retested and discussed.

Collaboration is a broad topic, thus it is perhaps understandable that a study cannot cover all possible aspects of the issue. In this particular case, two issues stand out as potential topic for further researches. The first issue is the indirect supplier management strategy applied at BD Vietnam. The question to be further asked is what methods can BD Vietnam apply to improve the quality of collaboration with its local suppliers, given the mediating role of the Saint Gobain CSO. Clearly, this question can only be answered using an extensive study focusing on supplier management or outsourcing management, which can be an interesting research topic for further studies. The second issue to be further investigated is the practice of inventory management in BD Vietnam. This study has briefly discussed in a simple way the inventory management strategy being applied at BD Vietnam. However, given the contrasting characteristics between the shipbuilding industry and the standard items supplied by BD Vietnam, it would be interesting to properly study the operational practices in inventory management applied at this company. The issues to be addressed would be the actual inventory calculation methods; how did the company deal with different specification and item's dimensions required by customers; or what forecasting techniques are being applied in order to deal with both the different requirements from customers and the unpredictable general demand in the shipbuilding industry. This topic can also be applied in a larger study involving more than one suppliers with similar characteristics as BD Vietnam. In general, it is believed that further studies of the two abovementioned topic will be valuable additions to the improve the quality of the findings presented in this thesis.

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Appendix

1.1 Interview transcript/guide - BD Vung Tau

1.1.1 1st interview (14.01.2016) - Transcript

Interviewer: Bich Le (Student) and Quang Minh Ha (Student)

Interviewee: Tor-Erik Sivertsen (General Manager at Brødrene Dahl Vung Tau)

Interview setting: the interview was conducted at 10am on Thursday 14th January 2016, at Brødrene Dahl Vung Tau's office locating at Street No. 7, Dong Xuyen IZ, Rach Dua Ward, Vung Tau City, Viet Nam

(Start of interview)

Interviewer: Can we start with a brief description of Brødrene Dahl Vung Tau?

Interviewee: Yes, let's me explain a little bit about Brødrene Dahl and its history. In 2007, VARD started working with their yard, which is located about 100 meters down the road (the current location of BD Vung Tau). Then, as one of the main suppliers for VARD, we were asked if we were interested in putting up a warehouse in Vung Tau. Then we did a market research, we worked a lot with the market in Vietnam, because VARD alone, with its turnover, would not be enough to keep the warehouse, and keep the employees in Vietnam. At that time, Vinashin group was quite big, and we'd already made some contracts. So we started, and we built the warehouse in 2009. So we have been here since 2009; from 2009 to 2012, we worked in the PetroVietnam Industrial Zone, and 2012 we moved to here.

We have struggled a lot since Vinashin went bankrupt, and the ship industry was quite low. VARD didn't have too many projects, but still, it is still the major reason we are here, but we are very vulnerable for the market subsidizes. VARD was above 90% of our sales in 2013, in 2014 it was around 70%, and in 2015, they were almost down to 50%. So we are working very hard to reach new customers, and still, the ship building activities in Vietnam is not so high as we could have expected. But foreign investors, for example Damen (a shipbuilding company from the Netherland), is really looking into Vietnam, and we can use our European expertise to approach them, and this has been a benefit for us. For this location here in Vung Tau, we are located here because of VARD. We also looked upon, when we first established, to locate in Hai Phong, but since VARD is here, it was more important for us to be close to VARD.

We are now 17 people employed in this office, we have 5 people in the warehouse, with 1 warehouse manager), 1 commercial manager who supervises purchase and sales, and we have also admin and finance manager for payments, invoicing controls, etc. But we are also a part of the Saint Gobain group, so we are using HR services, also more heavy finance help, etc. from their "Shared service center" in Hochiminh City. Our license in Vietnam is under Saint Gobain license, we don't have our own license; so our business license is a part of Saint Gobain's business in Hochiminh City. So, our reports and all legal stuff are going through Saint Gobain...

Interviewee comment: including payment?

Interviewer: including payments, yes. For example, Saint Gobain has the export rights, but we wanted the export rights ourselves so we can approach the customers and don't to go through Saint Gobain to make the exports. Last year, we received the export rights. So, by achieving this export rights, we have actually had quite high sales with Japan, and of course this is project based sales, but it maybe will make it easier for us to look for customers abroad.

So, being a part of Saint Gobain has helped us, but at the same time, it is a little bit more difficult...

Interviewee comment: it constraints your power?

Interviewer: yes, it maybe has some constrains... But back to BD Vietnam, the day to day business is to sell equipment. As you have already known, most of the items come from BD Norway, but we also purchase quite a big amount of items from China, and from local suppliers in Taiwan and also Korea. But the main steel products are coming from China. And for that we are using what we call the Saint Gobain sourcing office, because we don't have self-employed people in China controlling and doing quality check for us, but we are using the service from Saint Gobain, who are also doing the same quality check for BD Norway, for other items which they buy and import from China. So this sourcing office is working for several businesses within the Saint Gobain business.

Interviewer: Is this easier to control the supplying process when you are using the center sourcing service from Saint Gobain?

Interviewee: yes, it's making it easier, because they have the portfolios, but we know the suppliers. The final decision making is done by us. They are out searching for suppliers and sending the quotations to us, and then we make the final decision of where to buy and what to buy. So the lists for purchasers are designed by us, and for several of these pipes suppliers and fittings and stuff like that, we have frame agreements with all of these manufacturers, so we don't have to source a lot every time. But the steel market in China recently has been very slow, and also China is struggling, so a couple of our pipe makers have gone bankrupt and closed down, that leads us to less options and less competitive in pipes. We are now in the process of sourcing for more pipes suppliers. But the problem is that we are not so big. Together with BD Norway, we are big, but only us in Vietnam, we are not so big so we don't have much to bargain with. Often the pipes suppliers have the minimum order quantity to be about 20 tons per dimension, and we need 10-15 each time, so this is a difficulty that we need to solve. And so these are the challenges we are having at the sourcing office.

And also, the quality issue. We have to instruct them. We had some problems in the beginning because they had some changes in people, and when they changed people, may be the knowledge is not transferred as good as it should be. So we have had a couple of incidents when we received pipes, which was good enough according to the standard, but according to our customers and our demands, it was not good enough. So we have now arranged for better quality check with pictures and movies about inside and outside of the pipes, so we are more involved in the instruction part of the quality check. So, they are performing it, but we are saying yes or no.

Interviewer: Does it cause challenge between BD Ålesund and BD Vietnam when the Chinese suppliers reduce in number and quality?

Interviewee: Not exactly, because they have their own purchasing department. BD Vietnam is not a part of BD Norway actually. We are the daughter company, but we are operating all by ourselves. But at the same time, when we buy items from BD Norway, we don't buy at the selling prices. So we are not joining force in purchasing, directly. We are purchasing for ourselves and they are purchasing for themselves. We have been thinking of joining the amount of mass we are purchasing. This will make us a bigger... buyer. But at the same time, we need to inform this is for Vietnam, this is for Norway.

Interviewer comment: for legal reason?

Interviewee: yes, for legal reason, and also for the honesty of the cooperation. This is very important. The benefit of the cooperation between BD Ålesund and BD Vietnam is that, as

I told you, we have a customer from Japan (Niigata). The technical parts for this customer, the valves, all the high-end parts, were supplied by Ålesund. We supplied everything else. So we joined the forces, and we made the delivery for this customer a complete package. But we deliver something from Ålesund, and something from Vietnam. So this is the way we are looking for applying for more projects, in the region of South East Asia. We have the higher turnover for these items in Norway, and normally these items are not so big, so you can get more packed in one container or even fly cheap by air. But for the pipes, the fittings, it is very big, so it is cheaper to ship local. So this is the model that started last year with Japan. It's been the idea all the way, but it has not really been functional until last year, but now we see it's functional and we see the benefits of it, so now we are looking to do more of this model.

Interviewer: Do you think this model is the reason why your sales dependence with VARD has been decreasing? Do you get more customers because of this model or is it more other tactics?

Interviewee: The last years we have done other tactics as well. We have increased sales with others. Of course, the Niigata sales was one big influence for this, but we also increased sales with Damen. We have had quite high activities towards Damen, to reach the high sales and meet their demands. This will also be very important for us in 2016, because of the current situation with the falling of oil price. And VARD is building ships for the oil industry, so they are very dependent on this. Right now they are looking into other ships, other markets, but it will take some times. Damen, they have completely different strategies. They are building smaller boats, and not directly relate the oil market, and these are boats built all the times, so this is a steadier market. So if we can have one foot on this market, and one foot on the other market, we will not be so dependent on the situation. This is the idea.

Interviewer: Are there any challenges in your cooperation between BD Ålesund and BD Vietnam when dealing with the Japanese customer?

Interviewee: We had a meeting with the customer in Japan, and my Sales Manager went to the meeting together with the Purchasing Manager in Ålesund, so they can have a clearer vision of what is the customer's expectation. They have been working very closely to make the delivery and minimize the faults. But at the same time, the customer has been informed about the split of the items, so everything that is dealing with the items we supply, the customer has direct contact with us, and for the items supplied from Ålesund, they have direct contact with Ålesund. But when they are contacting Ålesund, we are kept on the topic, and the other way around, so we know what is going on. So, we have full overview of the communication, and this is important, in case we can help if something is needed.

Interviewer: So the information system is automatically updated between BD Ålesund, BD Vietnam and Japan?

Interviewee: Yes, it is always updated wherever you are in the process, which is very important. I think the model that Ålesund has for following up the customer has been adapted here. Say for example, according to VARD, we have the list, the MTO, and we are supplying according to this list, which is updated from time to time. This list is kept in a shared data warehouse, so everybody in sales can go in and see what has been delivered, what is updated, etc. So we have everything up to dated all the time. This is also the idea of doing with other customers, but we have not come to this point, because it is more difficult for other customers rather than VARD. We have been working so close with

VARD, like a both ways relationship...(?). But this is the idea with Damen, we can use this knowledge we have about supplying to VARD, to use it also for Damen. Says we know they are producing about 40 boats per year (small boats?), so if we can have full overview of the production scale, so we can make the procedure of doing the supply.

Interviewer: Regarding the relationship with VARD, we have been informed that you are doing Vendor Inventory Management with VARD, and they basically allow you to get into their system and control the inventory, is that correct?

Interviewee: Almost, not entirely correct, because we are not entering their system, but we have good knowledge about what they have in stocks or not, because we are informed by them. We are not in their data warehouse, but we are informed by their purchase manager about what they have in stocks and what they need, etc. For items that we need to keep on stock here, we know their status there (at VARD warehouse). Their idea is to have no stock at all, and everything to be kept here. We are keeping the redundant stocks for VARD here, in our warehouse, so we keep control of their stocks. And this is sort of the way of cooperating. Before every project starts, when we have the MTO, then I go to VARD with the complete stock lists of the MTO, and I show them what we have on stock, what needs to be ordered, what is the delivery time for this, etc. So everything on this MTO can be scheduled on the production plan, so we are working very closely with them. This is to avoid delay, avoid us end up having a too big warehouse, because it is costly, and so the turnover of the items is what we expected. We also have several meetings, in the beginning and after the production has started, so we can update the information.

Interviewer: Should there be any customization during the production process from VARD, then production plan might be changed...how do you deal with that?

Interviewee: then we are informed, but usually by email. If they plan to do some changes, then we are informed by email. In January (2016), they have an urgent project which is a big accommodation module which they have 3-4 weeks to build. All the items need to be shipped, both from Norway and Vietnam, very urgently. So they informed us about this project, then we will have some meetings in advanced about the status of the items (this needs to be shipped, this we have on stock, etc.). We plan everything with them. And so all other projects are put on hold, delayed, or...But say in the MTO you have a big list of pipes, we have an agreement that we should always have one shipset of pipes and fittings on stock. So we always have extra stocks here the whole time, so if some unseen thing happens, if they have a sudden project, then we can deliver. But other items are based on purchase order, we are only buy them if we receive the purchase order from them, because these items are different for each ship. These items will be purchased very early in the process because they are in the MTO list, and we will keep them in stock, even when we have the PO. We will not sell it to VARD until they need them, but we order the item to keep them here, to avoid the delay. The idea is we purchase the items on the MTO list and keep it here. When VARD needs it, we receive the PO and send the items to them. So everything is done according to they requirements.

Interviewer: so you don't need to have any forecast?

Interviewee: not according to VARD, because we are working so closely to them. But it is different for other customers. For them we need more forecast. But ship building is very different from others, because it is very project-based. You might have a project now, and then silent for maybe 4 months, and so on, so it is very up and down.

Interviewer: Do you have any communication method to know if they are satisfied with the product or not?

Interviewee: VARD has just recently done an audit for us. We are waiting for the response. When they do the audit, they check the warehouse, all systems, quality of products, everything. Last time we did well.

Interviewer: Is it base on project or it is per year?

Interviewee: I think it should be per year but they do not do it every year, it is from time to time. So it is not project based, I think they do it when they have time.

Interviewer: Should there be any conflict with VARD, how are these conflicts solved?

Interviewee: I would not say it is a very big issue, but it happens. Normally, when conflicts happen, it is because we forgot to purchase enough material, or something is missed out on the MTO lists, or they have miscalculated the items, etc. This is the normal conflicts, not enough material. In the beginning, I think it is very important for both parties to find out who did the mistake, but now as we are working so close with each other, it is more important to find the solution. Because we are on the same boat, if VARD does good, we do good. We are dependent on them and they are dependent on us. I think we have gone to a very positive stage of the cooperation with VARD, both parties are looking for a win-win situation.

Interviewer: what is the biggest challenge so far resulting from you being a warehouse for VARD, or if there is any challenge at all?

Interviewee: I don't know if this is a biggest challenge, but we are also helping them with technical issues. So, the challenge is to predict or recognize where the difficulties might happen so we can be aware of the problem soon enough, then maybe we can advise VARD and at the same time we can order the items in due time, so the delay will be minor. In every project, especially when the project is new, they don't know, something can happen. Then we can rely on the expertise we have from BD Norway, and of course VARD can do the same with their expertise. We have a very good connection with VARD, so we can see the lists of items that had been delivered to them in the past (from Norway), for similar projects, so we can control it and see if something is missing. So this is may be one of the challenge, to see the problem soon enough.

Our stock has been too high, because we started in 2009 with the big production plan for Vinashin, which went bankrupt. Our stock was too high, and we are still struggling with a lot of these items, and VARD is not using these dimension. We have done a big effort in reducing these stocks because the costs of these stocks will be too high. Keeping the needed items in stock is important, but due to high stock level, we did not have the freedom to maybe take some risks. For example, for some items we know that VARD will buy them, because if they don't use them for one project, they will use is for another project. But we did not have the freedom to do that before, but now the stocks are reducing, so we are gaining some freedom to do that. This, I think, will be more benefit for us and also for VARD, because we can take some risks in purchasing even before we have the PO. So this has been one of our challenges, to reduce the old stock and at the same time keeping the stocks that we need to have turnover on...

Interviewer: which you did overcome?

Interviewee: yes, now we have. We reduced it (the stocks) significantly this year (2015). We have the warehouse, on the side of which we used to have outside stocks. We managed to reduce that by transferring some of that inside, which is good enough, and scrapping them. So we don't have the outside stocks anymore. This is also due to the quality of the stocks, because of the humidity, after one year it is rusty. So, by keeping everything inside,

we can keep the quality of the pipes and fittings longer, so it is more positive. This was something we did last year.

I would not say that we are working by lean (principle). The Vietnamese way of doing things is a little bit different than the European's. It is also not so cost-beneficial because the workers or the employee costs are not so high in Vietnam, so you cannot compare it to Europe. So, by doing time efficient things in Europe does not always apply to be good enough, to be implemented in Vietnam. So you have to think a little bit different, which is the challenge.

Interviewer: Between BD Vietnam and VARD, should there be some knowledge sharing process?

Interviewee: We have been thinking about it. VARD also has a warehouse. Everything that is delivered from us, is to their warehouse, and they are distributing the items to different projects, because they have several projects at the same time. We have been talking about an exchange knowledge program, sending our people their warehouse, and vice versa; also by having our warehouse manager over to see how they do things. By doing this, we can make our people understand more what they need, how they expect things to be delivered, and the other way around. We have not finalized when to do this, but this is something we plan to do in the coming months. I think we will aim for March, and it should be done by April.

Interviewer: Does BD Vietnam have any physical investment in VARD?

Interviewee: No

Interviewer: Do you supply any service to VARD, like maintenance?

Interviewee: No. The only supply the items, and keeping the redundant stocks. That's the service we supply. But for Damen, we do extra service, such as oiling or repainting the pipes. Most of the pipes we sell to Damen is already painted. We do not have our own paint workshop but we use a local paint workshop for that service. We have talked to VARD about this service, but they are doing it themselves.

Interviewer: Would you be willing to apply the relationship model with VARD for other customers? Would you make some changes in the models with other customers?

Interviewee: We can use the model to work with other customers, but of course we need to do some changes. VARD is building 3-4 ships a year, so the process for each project will be long (3-4-5 months), so the follow-ups and the changes in each project is quite high. If you compare this with Damen, for example, they are producing 40 boats a year, so maybe it's 1,5 weeks for each boat, which means that you have to follow up in a different manner. The timeframe for the small boat is very short, so you cannot have the big changes. So here, you need to have a higher percentage of extra material, so you might need to think 3-4 boats ahead, which means you need to have the minimum stock of 3-4 ship set. So, you need to think a little bit different, but you can use the same follow-up process in checking the material, MTO, working with the production plan, etc. All these things that we learn from VARD, we can use for other shipyards as well.

Interviewer: How hard is the inventory management here?

Interviewee: we are having weekly report, automatically in the system. However, it is not working quite as we want, and we are also using manual check. In this manual check, which is Excel based, we have the minimum and the maximum. The maximum is not so important but the minimum is very important. This is based on previous projects, and the ship set that we have in the framework agreement with VARD, but at the same time, a lot of the same items are also used by other customers, so the minimum quantity may have to be higher than the ship set. So, all of these calculations are taken into consideration of the minimum quantity we need to have. And at the same time, 2015 was a busy year, but 2016 is quite different with not so many projects, the activities are low, so maybe our minimum does not need to be so high as in 2015. It is a little bit different than in BD Norway, as there it is automatic fill up when the stock gets down to some level, because in BD Norway you have a wider consumption from customers, much more reliable. Here it is much more project based, it is very difficult to know, but here some items are also automatically ordered.

Interviewer: but does it (project based inventory?) cause any problem with the Chinese suppliers?

Interviewee: the problem with the Chinese suppliers is delivery time. Often the delay for items is due to manufacturer's faults. We have had several problems with some Chinese suppliers because of delays, and this has been a headache. They say 1 month then it takes 3 months. During the communication process, the sourcing office are in the middle.

Interviewer: Are these problems caused by the manufacturers themselves or the shipping companies?

Interviewee: It is almost entirely from their (the manufacturers) side. The challenge sometimes is quality, when they have to redo the pipes which might take 1 month or 2 weeks more. Sometimes the labelling is wrong, even though we sent the instruction and everything, then they need to change it which takes 1 extra week. I have learnt that dealing with Chinese suppliers, we really need to be 100% correct. There cannot be any communication mistake.

Interviewer: Should there be any policy to restrict this issue?

Interviewee: of course we have the contract. Every time we buy something from a supplier, we have a contract, if not a frame agreement. In this contract, there are a lot of things that they need to do. But we are so dependent on this, if we stop buying because they do not meet the requirement, and choose another supplier, which will start all over again, we will lose time. And time is very important in this business. Usually we have some claims for them, but it is very difficult to get the knowledge of everything.???

Interviewer: that's why the supplier portfolio is quite important...

Interviewee: yes, very important. It is also related to what I said about the quality check performed by the Saint Gobain sourcing office... This is why it is so important to avoid the mistake before shipping. It is very difficult to deal with when you receive the not so good quality items, but if we can do it in advanced, it is much more easy.

Interviewer: Have you experienced any special business culture when doing business with your customers in Vietnam? Is it similar to China?

Interviewee: Yes and yes.

Interviewer: so you always have to be very precise?

Interviewee: yes, very. We are also non tolerant for corruption. We had one incident when we want to buy pipes from a supplier, not Vietnamese but they have a rep office in Vietnam. This Vietnamese seller approached me, we had a good price, but at the same time he is offering me 10%. I said I cannot accept it, but I would be happy to receive another 10% discount on the order. In the end, we finally receive 10% extra reduction in the order, and we are still working with this supplier until now, with no problem.

Interviewer: what about customers?

Interviewee: Yes, we have several cases with the Vietnamese customers as well. They don't ask directly for money, but they asked us to be flexible. It is a bit hard, and it is holding back our business, making it more difficult. What supprises me is that for some people, this is not corruption, it is more the culture. I think it is preventing the country from development. It is making it more difficult for the people who want to invest in the country, to do it. A couple of months ago, I was in an economic meeting with several American people, and they said that they are now seeing the trend that the foreign direct investors are not so eagle to invest in Vietnam anymore, because of this. Big companies, they want payback for everything they spent. If you invest 100 million, you don't want to use 10 million to something when you don't know where is goes. You need to know where everything is. So it makes things difficult. But, Vietnam is working with the Free Trade Agreement, it is also interesting for us. But we still deal mostly with the European or Western partners.

Interviewer: that is actually my next question, as when you are thinking of expanding the business, would you accept this as a part of the business culture and reach for Vietnamese customers as well?

Interviewee: since we are not doing any thing like this (corruption), some contracts which could have been signed was not signed, because of this. So I see that if we are expanding, we are expanding with other customers, who are in the same thinking as we are.

Interviewer: Does the decrease in sales to VARD affect your relationship with VARD?

Interviewee: we are not decreasing sales with VARD, we are increasing the total sales. It is the proportion that changes.

Interviewer: Who is the next big customers beside VARD?

Interviewee: It is the Damen Group. Damen has several joint ventures in Vietnam, and 1 shipyard for themselves. They have 1 shipyard in Song Tu, together with the Song Tu shipyard in Halong Bay, and they have Damen Song Cam, which they own, and then they have Song Cam. The shipyard in Halong is the old Vinashin yard, and Damen was there for the technical issues. All Vinashin's project was for Damen, so they control the purchase. But we are selling to Halong, since Damen is only using the shipyard. But without Damen there, they have no project. Damen Song Cam is Damen yard, and they are using Song Cam and Ben Kien to build hauls, and then in Damen Song Cam they will do the outfits. So, together with all these yards, Damen is number 2 (biggest customer beside VARD).

Interviewer: What is your thought regarding your business in the next years, in terms of how your sales proportion are going to change among these customers? Are you planning to continue decrease the sales proportion with VARD (about 50%) or are you willing to keep it at 50%?

Interviewee: I think it will be above 50%, maybe between 50-55% with VARD. If I can choose, I would not have VARD on 30% or 40%, but I cannot. In 2015 VARD has all time

high in production, so we have never sold as much as we had to VARD last year, but we sold even more to others. But we are having this invoice issue with Damen, as I told you on the email. For Damen, we are selling to Halong, to Song Tu shipyard, and then this shipyard adds 15% before they send the invoice to Damen. Damen wants to buy directly from us to avoid that 15%, but the way they want to do it is for us to deliver in the yard in Halong, and then send the invoice to Holland. By the Vietnamese law it is not allowed. So we are looking for ways to solve this issue, because by solving this issue, I think we can double the sales with Damen. The reason why is because we don't sell anything yet to Song Cam and Ben Kien, for the whole yard, and they are the biggest quantity, since they are making all the pipes and everything, maybe you can consider 40 tons a year?, and we still have not sold anything to these yards yet. But if Damen buys from us, they will buy and provide materials for this. Our budget this year is higher than the budget last year, but at the same time it is lower than we actual received last year. So this year according to the oil price, according to the market, according to the feedback we have from VARD, it will be a very tough year. So we are almost depending on that something will happen with Damen, or other customers around SEA. But we are still positive.

1.1.2 2nd interview (11.03.2016) – Guide

- is the joint force of bd norway and vietnam applied for damen as well? how long have BD been working with Damen in general or Damen Song Cam in particular? Sales proportion for each year? What are the communication methods throughout an project?
- how long have BD been working with Niigata? what are the sales proportion in each year? what is the main communication method throughout a project?
- when joining force with BD Ålesund, how is the logistics arranged? how are the parts transported?
- regarding the joint force with BD Norway, how different are the outcomes in terms of economic saving and logistics?
- what is BD's thought of a common is where the customers are integrated as well?
- how have the knowledge sharing program between VARD and BD vietnam been processed? if it have started, have you seen any immediate benefit?
- challenge relationship with BD Ålesund? framework agreement with them? communication problem (is that through saint gobain sourcing office as well)?

1.2 Interview guide - BD Maritime (04.12.2015)

1. Brødrene Dahl Maritime

- a. Department function
- b. Administrative & logistics operations of...
- c. The network with other firms
- d. Relationship with BD Vung Tau
- e. What are the challenges of doing business in BD Vietnam?

2. Supplies to BD Vung Tau

- a. Patterns of supplies to BD Vung Tao
 - types of goods & suppliers, 80:20? Etc.
- b. How do you rate the level of behavioral uncertainty at BD Vietnam, in terms of last minute changes of order, order frequency, order quantity, etc.
- c. What kind of wastes and errors usually occurs in the transaction with BD Vietnam
- d. Are there any technological challenge regarding information sharing between BD Maritime & BD Vung Tao?
- e. What is the role of the Chinese partners (warehouse, suppliers or manufacturers)?
- f. What value does this tier contribute to the business relationship with BD Vietnam?
- g. Is this tier included in the SC information system?
- h. Where is the payment coming from? Where do you send the invoice to? Due time for payment?

3. The relationship with Saint Gobain

- a. Branding effect in Vietnam?
- b. What are the main role of the in the transaction process between BD Maritime and BD Vietnam?
- c. Does it involve in the payment process? If it does, has there been any problem arisen from this involvement?

4. Customer service

- a. Describe the order fulfillment process
- b. How is the logistics service provider (LSP) chosen?
- c. Tracking & information system for orders control in general?
- d. Does the LSP work directly with BD Vietnam after being appointed?
- e. What is the minimum and maximum lead-time?

5. Future of BD in Vietnam

- a. Describe perceptions about challenges and opportunities.

1.3 Interview guide – VARD Vungtau (14.01.2016)

1. VARD Vungtau

- Company's general information
- The network with other firms
- What are the challenges of doing business in BD Vietnam?

2. Suppliers situation

- Number of suppliers in the region?
- Percentage of items supplied by BD Vietnam over all suppliers?
- Are there similar supplier management strategies being applied to all suppliers?

3. Collaboration practices with BD Vietnam

- Elaborate on the warehouse service provided by BD Vietnam. How important is the additional service when it comes to suppliers relationship?
- Elaborate on the detailed collaboration process (VMI collaboration)
- What stands out in the relationship with BD Vietnam, compared to the relationships with other suppliers?
- Are there any challenges in the ordering process with BD Vietnam?
- Please elaborate on the knowledge sharing program with BD Vietnam? How beneficial do you think the program will be? Is confidentiality a potential issue?
- Do you have any capital investment in BD Vietnam or BD Group?
- Do you think BD Vietnam has a good policy regarding customizations and changes?
- What are your opinions of the future of the collaboration with BD Vietnam? Do you think the current sales proportion with BD will change?

1.4 Interview guide – DAMEN Songcam (23.03.2016)

1. DAMEN Group, DAMEN Songcam and DAMEN businesses in Vietnam

- Overall information of the company?

2. Suppliers situation

- How many pipes and valves suppliers do you have in total? In the region? How many percent of the total purchase value are for items from BD VT?

3. Collaboration practices with BD Vietnam

- When did the business with BD Vung Tau start? Do you have a framework agreement with BD VT?
- What is the reason for choosing BD VT as a pipes and valves supplier (anything to do with the Saint Gobain Group)?
- Does BD VT provide any additional service beside supplying the items?
- Are the items supplied by BD differ from project to project, or are there any common items that BD can store and supply to you regardless of the project specification?
- What communication methods are used in exchanging business issues with BD VT? Has there been any problems caused by fail communication by the two companies?
- Are the two company share information with each other? How often? What kind of information are being shared?
- Do the two company have any mutual investment, strategic planning involvement or knowledge exchange program? Do you plan to have such things in the future?
- How do you evaluate BDVT's overall performance so far? Do you have an annual performance evaluation for BDVT? What are the criteria?
- What are your expectations of this supplier in the future?

1.5 Questions for the Saint Gobain CSO (26.04.2016)

- In rough number, how many percent of BD's local suppliers are from China? How is the current situation of these Chinese suppliers, regarding the recent economic downturn in China?
- Can you describe a standard suppliers sourcing process for BD Group? Is there any differences in suppliers sourcing process for BD Group and BD Vietnam?
- Should there be an issue at the suppliers that effect the order process, how do you approach this issue in relate to your partners at BD Vietnam and BD Norway?
- What are some of the challenges for the sourcing office regarding the role of a middle agent for BD Group and its suppliers?