Master's degree thesis

LOG950 Logistics

Analysis of Rush Orders: A Case Study of Jets Vacuum AS

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Preface

This master thesis is the final stage of the Master of Science in Logistics degree at Molde University College - Specialized University in Logistics. The thesis has been written between January and May 2017.

We would like to express our gratitude to our supervisor Per Engelseth for his guidance in the form of academic knowledge and constructive feedback throughout the writing process of our master thesis.

Furthermore, we would like to thank Jets for the opportunity to write our master's thesis in cooperation with the company. We also want to thank everyone at Jets, the dealerships and the representatives who have been participating in our interviews. You have all showed great participation and willingness for this research. At last we would especially like to thank Knut Olav Naustenget for everything he has done for us throughout this master's thesis as our contact person.

Molde, 22.05.2017
Vegard Pettersen and Inge Finnes Saunes.

Summary

Sanitary systems play a vital role when it comes to hygiene and for having a pleasant environment, and therefore it is important to keep these systems running continuously. Jets Vacuum produces and supplies vacuum sanitary systems to installations both on- and offshore worldwide. If there occur any problems with the system and there becomes an urgent need for spare parts, a rush order could occur at Jets. Rush orders could also occur at Jets if there comes a request for a production of a sanitary system within a short amount of time.

The purpose of this explanatory case study is to analyze these rush orders and to provide a better understanding of them. More specifically, we seek to explain what causes the rush orders, what effects do they have on Jets, and what can be done to reduce the number of rush orders and ease the effects rush orders have on Jets.

To provide a better understanding of rush orders, literature about rush orders have been reviewed alongside with literature about spare parts. Additionally, literature about demand uncertainty, product complexity, product variety, customer service and after-sales service have been reviewed, because they are relevant factors for the understanding of rush orders. Also, literature about supply structure and segmentation has been reviewed. Our empirical data is collected through interviews with employees at Jets who are involved with handling rush orders. Also, Jets representatives and dealerships that are handling customers and end-users with Jets systems are interviewed.

Our findings show various causes for what causes rush orders to be placed at Jets, and the lack of spare parts further downstream in the supply chain is one of the main causes. But also insufficient communication, cultural differences, inquiries from customers regarding faster delivery, poor purchasing planning, and lack of knowledge about the product also causes rush orders. Our findings also reveals what effects the rush orders have on Jets such as how it affects both the production and the inventory, it causes extra costs, and it creates a stressful work environment. At last we have suggested some solutions that we believe can reduce the amount of incoming rush orders and solutions that can ease the effects rush orders have on Jets.

Contents

Figure list

1.0 Introduction

In this introduction, we will briefly present and describe the background and motivation related to the subject of this master thesis. Further, our focus will be presented that will define the scope and the outline the study. At last the purpose of the research will be presented.

1.1 Background and motivation

This thesis is the final part of our master's degree in logistics at Molde University College. We were eager to find a company to write our thesis with so that we could get an insight in how the logistics in a company functioned and how they faced different logistical challenges. We were therefore very grateful when they got the unique opportunity to collaborate with Jets Vacuum AS in writhing our master thesis. Jets Vacuum AS, which will be referred to as Jets, is a Norwegian firm that operates in the sanitary system industry, were they have specialized themselves in producing advance vacuum sanitary systems. Over the years, Jets have grown into becoming an international firm and they are operating in many different markets with customers all over the world. Therefore, Jets was a very suitable company to write a thesis with within logistics.

In the first meetings with Jets, we discussed some possible topics within logistics with the production manager, who now is the current site manager. Rush orders from customers were pointed out as a topic that could be interesting to perform further research on. Since sanitary systems have over the years become a necessity since it plays a vital role when it comes to hygiene and for having a pleasant environment, it is important to keep these systems running continuously. Therefore it is important to handle these rush orders as quick as possible and supply the customer rapidly.
These rush orders caused some problems at Jets within the following:

- Production planning – the rush orders were causing problems for the production because the rush orders are not planned productions and they need to be produced within a shorter time than a standard order.
- Standard orders – the rush orders were prioritized and were handled first, which could cause the backlog of standard orders to increase.

- Inventory – the spare parts that the customers rush orders are often the same parts used for production, and in some cases parts were taken and delivered to customers without registering them in the ERP-system. This lead to problems for the production department when they were going to produce a system because they were short of parts, although the ERP-system showed that there were parts available.
- Service level – handling rush orders is perceived as a service that Jets provides and they have some expectations for deliverability. By having a high service level is both expensive and logistical challenging.
- Stressful work environment – rush orders are one of the main drivers for stress at Jets, and the stress could lead to human errors such as taking parts and ship them to the customer without checking if the part was available or not.

As for Jets, they were interested in knowing more about why the customers placed these rush orders and if there where solutions to maybe reduce the number of incoming rush orders.

1.2 Focus

Our study is focusing on rush orders that are placed directly by customers to Jets or through dealerships or Jest representatives who have customers with Jets systems. We have also focused on the departments at Jets that are involved when a rush order comes in.

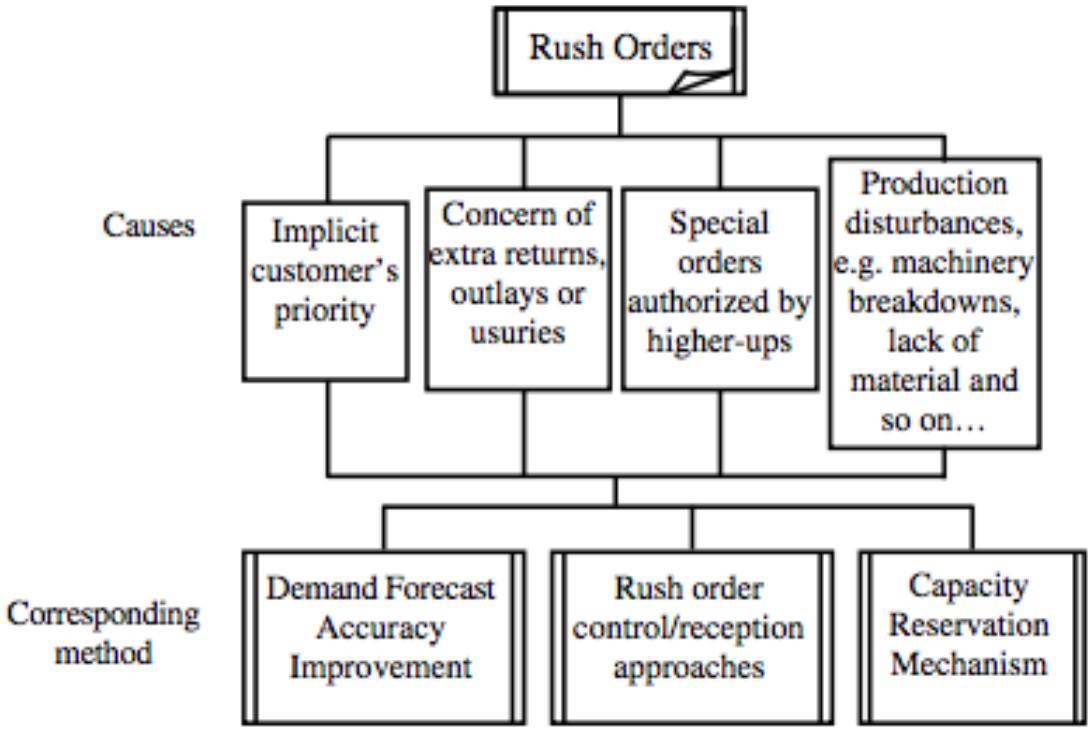

Figure 1: Causes and the corresponding solutions for rush orders (Wang & Chen, 2008)

Wang and Chen (2008) have studied rush orders where they have come up with a figure that illustrates some general causes and solutions for rush orders (Figure 1 above). In our study, we want to further develop this model, by studying rush orders and not just focusing on identifying what causes the rush orders and identify solutions, but we also want to determine what effects do rush orders have on Jets. For the cause, we will focus on finding what causes rush orders to appear at Jets. Further, we will seek to find what effects the rush orders have on Jets. And in the end, we will try to suggest some solutions that might reduce the number of rush orders and some solutions that might ease the effects rush orders have on Jets.

Out of 8506 incoming orders that were finished in 2016, 682 of these orders could be defined as rush orders according to Jets. The rush orders come from customers all over the world, and the customers are both private customers and companies that have end users located both on land and offshore.

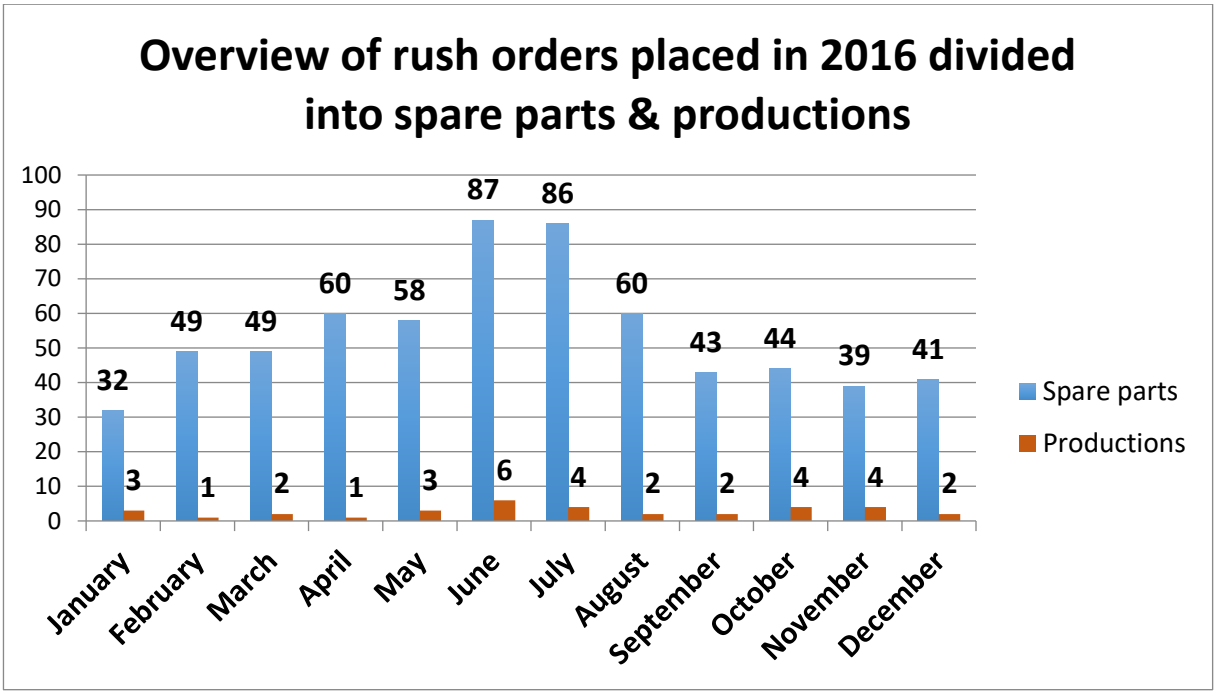

Figure 2: Overview of rush orders placed at Jets in 2016 divided into spare parts and productions

Figure 2 illustrate an overview of rush orders placed in 2016 divided into spare parts and productions. Out of the 682 rush orders in 2016, 648 of them were categorized as spare parts while the remaining 34 were categorized as productions. There will be a focus on both spare parts and productions, but since the majority of the rush orders are spare parts, there will be more emphasis on spare parts than on productions in this thesis.

1.3 Importance of the research

There has not been a lot of research in logistics within the sanitary systems industry. By searching in Google Scholar on keywords such as “sanitary systems industry” or “toilet systems industry”, “logistics” and “rush orders”, indicated that there had not been a lot of research done within logistics in the sanitary systems industry. As for rush orders, there was some research done in that field, but not in the perspective of the sanitary systems industry. Therefore, we hope that this research will contribute to new literature within logistics and rush orders by analyzing an industry that has yet not been researched on.
As for Jets, this research will hopefully give them a deeper understanding of rush orders. This could help them in the handling of rush orders, but it could also be beneficial for customers that could receive help from Jets in how to try to avoid placing rush orders. We believe it could strengthen the relationship between Jets and its customers.

1.4 Purpose of the research

The purpose of this study is to provide a better understanding of the incoming rush orders at Jets and try to explain what causes the rush orders, what effects do they have on Jets, and what can be done to reduce the number of rush orders and ease the effects rush orders have on Jets. Based on this, it leads us to the following research problem for our thesis:

How do rush orders at Jets occur, what impacts does they have, and what could be done to improve the current situation?

To be able to answer this research problem, some research questions need to be made. These research questions will be introduced later on in 2.6.

2.0 Literature Review

In this chapter, there will be presented literature that will provide a frame of references to the subject studied. The literature used in this chapter is derived from different literature reviews, and it will be used later on in the analysis.

2.1 The choice of literature

This thesis concentrates on the problem of rush orders, which would be elaborated and explained with some underlying literature. In the first section, relevant literature on rush orders would be presented to give a good insight to understand the causes, what effects rush orders could have, and what solutions have been proposed. Further, literature about spare parts will be discussed because the majority of the rush orders that occur at Jets are spare parts. Additionally, literature on demand uncertainty, product complexity, product variety, customer service and after-sales service will be reviewed, because they are relevant factors for the understanding of rush orders.

Secondly, we move to the literature about supply structure, which is relevant to the understanding about how Jets as a supplier supply their customers. Within this section, there will first be a general presentation about how a supply chain network is set up and mechanisms within it. Additionally, there will be reviewed literature about the importance of information in the supply chain network, and a presentation about the supply chain strategies of being efficient or responsive.

Thirdly, literature about segmentation is reviewed. The reason for this is because Jets have used segmentation as a solution in how to handle the incoming rush orders.

2.2 Rush order

To gain a fundamental understanding of what rush orders are, one would need to look at what the litterateur have already covered about this subject.

Trzyna, Kuyumcu & Lödding (2012) define a rush order as: - *"The definition of rush order is an order that did not arrange within time of the current schedule placed in a very short time of delivery, and need to be handled in a very short period of time"* (Trzyna, Kuyumcu & Lödding, 2012). Since the rush order has its requirement due to time, it takes many

resources to fulfill the rush order in time. Further, Yao and Liu (2009) have classified all the different orders that might show up in a firm and divided them. The first one is special orders, which comes from one enterprise with one time-threshold and it has its own and unique design. The second one is general orders, which is all orders beside special orders. Like Trzyna, Kuyumcu & Lödding (2012) mentions, Yao and Liu (2009) argues the importance to elaborate more to get a clear understanding what rush order means and state that the time threshold when the rush order arrives is the very important, as well as the impact on the surroundings. Yao and Liu (2009) explains rush orders as; - *"…the orders that should be given the highest priority to operate to fit the urgent delivery date of customer are named rush orders which are not restricted by the time threshold"* (Yao & Liu, 2009).

Svensson and Barfod (2002) argues that the main problem of getting the right material at the right time to be a direct consequence of why rush orders show up. When material was missing, it causes planned orders to be delayed. Svensson and Barfod (2002) refer to this as a simple but a common problem, and in most cases, this lead to delays in the production or rush orders. The importance of having the right documentation at the right time to keep the flow of information going smoothly is also important due to rush order issues. According to Yan-Hai et al. et al. (2005), the result of missing documentation causes it difficult to be able to plan properly, and the quality of the product is too variable, which underlines how crucial it is to have the right information at the right time. Not only for themselves, but also for the customer to understand their actual requirements.

As a direct consequence of incoming rush orders showing up, Plossl (1973) stated that there is a clear relationship among rush orders and delays of standards orders due to delays, how a higher share of rush orders would affect and delay of standard orders. Also, Chen (2010) argues the importance of how rush orders could provoke the schedule for standard orders. Is it worth accepting rush orders when one take into account delays of standard orders and what it might cost them? Therefore, one should decide whether one should accept the inbound rush order or not.
Kim and Duffie (2004) mentioned that the effect of unplanned orders such as a rush order caused lead times to vary widely, backlog significantly increased, and work in progress (WIP) vary due to poor coordination of input and output. Other aspects of what rush orders causes, Ehteshami, Petrakian, & Shabe (1992) argues how rush order would decrease the

service level on standard orders, and increase the stock level, increase the cost of delay, and increase the unpredictability of the production system that they use. It would affect how the current schedule plan was supposed to work, and one would need to rearrange it by prioritizing rush orders since it has high priority to satisfy the current requirements (Ehteshami, Petrakian, & Shabe, 1992).

To be able to handle these rush orders better, different authors have discussed some solutions of how one could handle them better. According to Davis (1993) one could smooth out the variation due to supply and demand, where the inventory works as a safeguard between what is required and what is being handled, this buffer would be very valuable when a rush order is assigned into the system. This relieves the schedule due to the planning and production. Also Wang and Chen (2008) mention that one could build the inventory level higher in advance to handle incoming rush orders better. Wang and Chen (2008) also argue that one could try to reserve some capacity if the manager wants to cope with the problem of rush orders. Nevertheless, the risk of handling rush orders with increasing inventory and reserving capacity could cause the resources to be wasted on nothing, and one could end up losing money. Wang and Chen (2008) argues that if not handling things in advance, one should have some specific criteria to handle the incoming rush orders, like the size of the customer, amount of the product is ordered or the profit it would create. Rush orders should be taken seriously due to the delivery time, the change in inventory level, the lack of capacity or need for it be rearranged, and especially the impact it would have on their existing customers and new potential customer due to relationships. At last, Yan-Hai et al. (2005) highlight the importance of how companies can cope with incoming rush orders and state that one should reschedule the manufacturing system so that they could finish in time. This also applies for standard orders. Trzyna, Kuyumcu & Lödding (2012) argues that if the case of having too many rush orders, the work in progress level must be set to an acceptable level so both rush- and standard orders could be handled.

2.2.1 Spare parts

The majority of rush orders that Jets receives (see Figure 2), are categorized as spare parts, so it would be important to get a deeper understanding regarding spare parts.

Spare parts are needed for maintenance of industrial systems and consumer products (Fortuin & Martin, 1999). Kennedy et al. (2002) argue that one can differentiate between two fundamental types of maintenance. The first one is scheduled or preventive maintenance, which they argue have predictable demand of spare parts. But Cohen and Agrawal (2006) argue that although some events are predictable such as scheduled maintenance, it is still difficult to forecast how many spare parts and engineers are needed for that. So one could assume that scheduled maintenance gives some predictability in demand and that it is more predictable than the second fundamental type of maintenance, which is unplanned repair. For scheduled or preventive maintenance, it might be sufficient if the spare parts arrive just in time, while safety stocks have to be applied to compensate for the demand variation for the unplanned repairs (Kennedy et al., 2002).
One can also differentiate spare parts and Fortuin and Martin (1999) divide spare parts into:

- Repairables – which are divided into non-interchangeable or one-of-a-kind items, and rotables, which are parts that can be swapped with an already serviced part. The non-interchangeable repairable is referred to as a part which has to be repaired and can therefore not be replaced by another part when it fails. The customer must wait until the part is repaired before the product can be used again. The repairable rotable can be replaced by an equal part when it fails, and the part that failed could return to the factory or to a special workshop for repair. After the repair, the part could be put in stock and be reused.
- Non-repairables – could also be referred to as disposables, throwaway parts, expendables or consumables. These parts are removed and replaced by new ones when they become defective.

In our case with Jets, customers' unplanned repairs often cause them to place rush orders. These unplanned repairs could happen anytime and anywhere, and Huiskonen (2001) argue that the demand patterns of spare parts are very difficult to forecast due to the high uncertainty. Martin et al. (2010) argue that spare parts demand patterns are in most cases

intermittent in nature meaning that it has not a constant, but an infrequent demand when there might be several periods without any demand between different demand occasions. Additionally, Martin et al. (2010) also argue that when demand occurs, it may be highly variable in size, which is described as uneven demand patterns.

2.2.1.1 Spare part inventories

Regarding how one should manage spare part inventories, it is very difficult for both, the suppliers and the customers. This because of the shifting demand, it is difficult for the suppliers to forecast the demand and therefore makes it difficult to know what parts to have in stock. While for the customers, it is difficult to know what spare parts they should have in stock because they do not need all types of spare parts in stock. Since after-sales service (see. 2.2.5) and spare parts are closely linked up, Cohen and Agrawal (2006) have illustrated in Figure 6 that in the after-sales service supply chain, the inventories turns only a few times a year. These inventories are referred to spare part inventories. They also illustrate that the number of stock keeping units are high, the product portfolio is heterogeneous, the required response time is very short, and the performance metric is product availability (uptime). All these factors make it difficult for the original equipment manufacturers (suppliers), and because the spare part inventories turn-around is very slow, it could cause parts to become obsolete over the years (Cohen & Agrawal, 2006).

Another challenge with spare part inventories are the challenges that arise when the production period of a product ends. Fortuin and Martin (1999) call this the final phase of a product, where the production stops but the service period continues, and there will still be spare parts available. However, after a while, the external suppliers to the manufacturing company will stop the production of parts and spare parts, and the manufacturing company must then place an order. Then one need to find out what spare parts one should keep in stock since the parts will not be able to be purchased anymore. To be able to find out what spare parts that should be in stock, Fortuin and Martin (1999) suggest that one should categorize them while Huiskonen (2001) suggest one should differentiate them with regards to what effects they have to the logistics system.
If we start with Fortuin and Martin (1999), they argue that deciding if an item is a spare part is not the same as deciding that it has to be stocked. Companies could have a catalog of 100 000 spare parts, but actually have 50 000 in stock. The remaining spare parts can be ordered, but would then need to be manufactured. To be able to know what parts that one

should stock or not, Fortuin and Martin (1999) argues that one can only find that out after a proper categorization of the spare parts. They argue that the spare parts could be categorized according to:

- Reparability
- Demand intensity
- Purchasing lead-time
- Delivery time
- Planning horizon
- Essentiality, vitality, criticality of a part
- Price of a spare part
- Costs of stock keeping
- Ordering/Reordering costs

Huiskonen (2001) argues that a logistics system of spare parts are described through the following elements: network structure of inventories in the supply chain, positioning of materials in this network, responsibility of control in the system, and control principles used for managing the materials. He further argues that companies should differentiate their spare parts based on their different effects on the elements in the logistics system. He proposes four control characteristics for spare parts, which he have analyzed based on their effects on the logistics system. The four control characteristics are the following: criticality, specificity, demand pattern, and value of parts.

The first characteristic, criticality, is divided into two aspects of criticality where the first aspect is process criticality and the second one is control criticality. Process criticality is related to the consequences of a failure and where replacement is no readily available. The downtime cost of the process could be a factor that could be used when evaluating the process criticality. Another approach could be related to the criticality based on the time in which the failure has to be corrected. One can differentiate between three degrees of process criticality:

- High criticality – the failure has to be corrected and the spare parts should be supplied immediately
- Medium criticality – the failure can be tolerated with temporary arrangements for a short period of time, regarding which spare parts can be supplied

- Low criticality – the failure is not critical for the process and can be corrected, and spare parts can be provided after a longer period.

The second aspect, control criticality, is referred to the possibilities to control the situation. Predictability of failure, availability of spare part suppliers, lead-times, etc., are factors that should be taken into account.

The second control characteristic, specificity, could be divided into standard parts and user-specific parts. The standard part usually has a high availability, many available suppliers, and there are stocks of these parts at different levels of the supply chain.
The user-specific parts are low volume parts that the suppliers are unwilling to stock and the control remains with the user himself.

The demand pattern is the third characteristic and will be discussed more in section 2.2.2 and earlier in this chapter. The aspects that the demand pattern includes are volume and predictability. In terms of volume, there are a lot of spare parts, but they have very low and irregular demand.
The failure process of a part and the possibilities to estimate failure patterns and rates by statistical mean is referred to the predictability of demand. The predictability could be categorized into:

- Parts with random failure
- Parts with a predictable wearing pattern.

The last characteristic is the value of a part and it is important in terms of stocking decisions. If the spare parts have high value, it makes stocking a non-attractive solution for any party in the logistics chain. Parts with low value should be handled in an efficient way so that the administrative costs do not increase unreasonably in proportion to the value of the items themselves.

			Criticality	
			Low	High
Standard parts	Value	Low	• Order processing simplified e.g. by automated orders or • Outsourcing of inventory control to a supplier	• User's decentralized safety stocks and generous replenishment lot-sizes
		High	• Stock pushed back to the supplier	• Optimized user's safety stock (with high and smooth demand) • Time-guaranteed supplies from established service company (for lower and irregular demand) • Several users' co-operative stock pools (for very low demand)
User-specific parts			• User's own safety stock + partnership with local supplier to shorten leadtimes, to increase dependability and get priorities in emergency situations. • In the long run, standardization of parts when possible.	

Figure 3: Categorization of control situations and respective strategies/policies (Huiskonen, 2001).

Summarizing what have been mentioned, Huiskonen (2001) has by using the control characteristics described some respective strategies/policies, which are described in Figure 3 above.

2.2.2 Demand Uncertainty

According to Angkiriwang, Pujawan and Santosa (2014), demand uncertainty is referred to as: *"…the probabilistic nature of demand quantity, types, timing, and locations. Demand uncertainty could be in the form of errors in the demand forecast, changes in customer orders, uncertainty about the product specification/mix that the customers will order, and competitor actions regarding marketing promotion"* (Angkiriwang, Pujawan & Santosa, 2014). Manufacturing companies, especially manufacturing companies that produce innovative products, are companies that experience order volatility from customers.

	Case 1	Case 2	Case 3	Case 4
Type of operations	Engineering to order	Make-to-order	Assembly-to-order	Make-to-stock
Level of uncertainty				
• Demand	Highly uncertain	Highly uncertain, customers frequently change orders, high mix uncertainty	Highly uncertain product mix, high product variety, demand fluctuating over time	Low demand uncertainty (orders received well in advance)

Figure 4: Demand uncertainty in different production environment (Angkiriwang, Pujawan & Santosa, 2014).

Angkiriwang, Pujawan and Santosa (2014), have in their case study of four manufacturing companies in Indonesia performed a cross-case comparison of them. The four companies are in four different production environments: Engineering to order, make-to-order, assembly-to-order, and make-to-stock. The result of their research showed the differences of demand uncertainty in the different production environments, which is displayed in Figure 4.

To be able to cope with different degrees of demand urgency, the use of multiple transportation modes could be a suitable strategy and it may improve customer service levels under highly uncertain demand (Angkiriwang, Pujawan & Santosa, 2014). Simangunsong, Hendry and Stevenson (2011) have also gathered some strategies that are suitable to cope with demand uncertainty through their literature review on supply chain uncertainty. The strategies they have gathered that could cope with demand uncertainty are the following:

- Postponement
- Information sharing between a manufacturer and its downstream partners, such as retailers
- Support from information and communication technology systems
- Use of strategic buffer stocks
- Lead time management

With the strategy of lead-time management, Simangunsong, Hendry and Stevenson (2011) argues that making delivery lead time promises to retailers that are longer than the actual lead time, could provide manufacturers with the flexibility to cope with unexpected changes in orders caused by end-customer demand uncertainty. However, this strategy has the disadvantage of reducing the speed to the market, and therefore it is more suited in a context where speed is not a competitive priority.
Production flexibility is a more suited strategy to deal with demand uncertainty when one need to reduce lead-time, for instance in more urgent situations. According to Chapman (2006), production flexibility is highly related to a reduction in lead-time. By having a very flexible production processes, the operation is more capable of easily and quickly shifting production to meet the changing demand.

2.2.3 Product Complexity and Product Variety

Sanitary systems are a complex product since it contains many different parts and with a fair amount of product varieties, the complexity increases. This has an impact on the incoming rush orders since it could increase the amount of different rush orders and therefore make it harder to know what the customer will order next both regarding productions and spare parts.

Closs et al. (2008) defines the complexity of a product to be - *"…from a multiplicity of elements, as well as from relationship among the elements"* (Closs et al., 2008). This brings out the importance of how difficult it can be to keep track of all elements of the product during the production. In addition, Blackenfelt (2001) describes complexity as the number of parts and the number of relations between the parts, but complexity can also be related to the issues of product variety since the variety directly affects the complexity. According to Svensson and Barfod (2002), the traditional way of producing a complex and highly customized product has shifted from the processing material to the ability to manage information, linked to the product and the production – this has affected the business processes significantly.
Further, Closs et al. (2008) argues that the market diversity, create higher complexity due to the product. To be able to meet the market requirements, one would need to meet it with more product variants.
However, to understand how to handle a complex product, Closs et al. (2008) argues that managers must keep their requirements in balance to increase sale. This could result in higher product complexity, like more features and variants, like Jets, would have to offer a sanitary system with more features or variants, to be able to handle the requirements for better operational efficiency through product rationalization. In many cases there is very difficult to say what is the optimal level of product complexity is, to ensure the right amount of cost and revenue. Blackenfelt (2001) mention modularization to keep up with the complex nature of a product - comparing all the technology aspects and business throughout the design process.

In the literature, they argue that complexity is directly connected with product variety, which leads us to why product variety needs to be discussed. Jets have a significant share

of various products they would need to assemble to complete the product and to be able to satisfy their customers and to be able to attract new customers in the future.

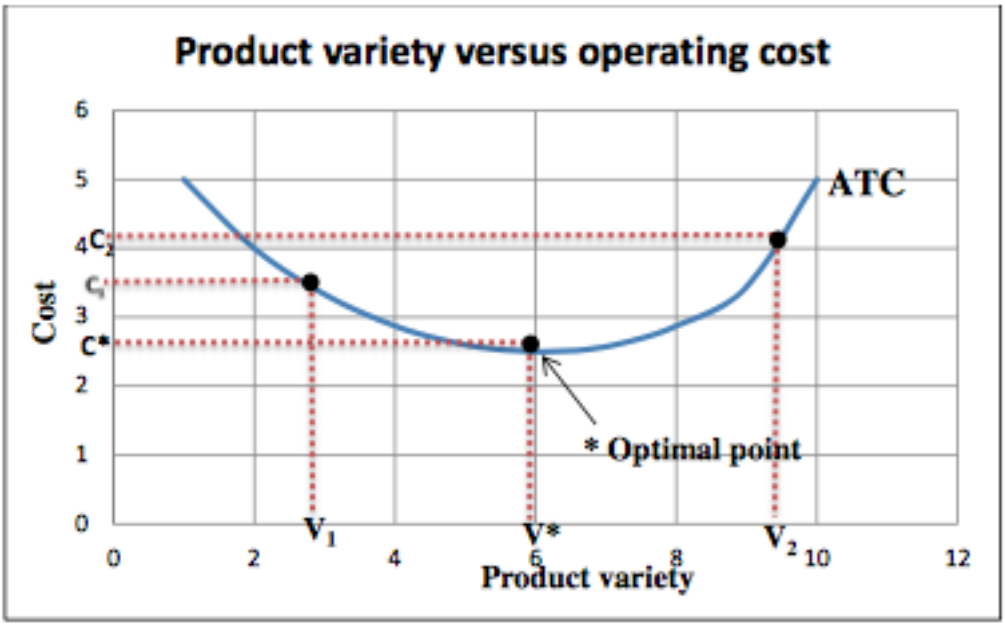

Figure 5: Product variety versus operating cost (Müller, 2015)

In figure 5 above one could use to identify and illustrate where the optimal number of product variety kicks in, that the cost versus the number of product variety causes the average total cost to be at its lowest. One could see how important it would be to have a clear understanding of what it means to provide the market with many different products regarding the cost. Like Wan, Evers and Dresner (2012), they argue how high product variety could affect the operations, such as fill rate, sales quantity, and cost impact, that there is a relationship between product variety and fill rate and sales. It shows that it has an adverse effect on each other. Wan, Evers and Dresner (2012) point out that it will create higher sales, but in the long run, it would decrease, and therefore it is crucial to find the optimal state of product variety. However, some authors point out other aspects to be important, like Pindyck and Rubinfield (2005), who proclaim that the inefficiency must be kept in balance; *"Any inefficiency must be balanced against an important benefit that monopolistic competition provides: product diversity. Most consumers value the ability to choose among a wide variety of competing products and brands that differ in various ways. The gains from product diversity can be large and may easily outweigh the inefficiency costs resulting from downward-sloping demand curves"* (Pindyck & Rubinfield, 2005).

Further, Varian (2003) claims: *"Firms may find it profitable to enter an industry and produce a similar but distinctive product. Economists refer to this phenomenon as product differentiation and that each firm attempts to differentiate its product from the other firms in the industry. The more successful it is at differentiating its product from other firms selling similar products, the more monopoly power it has"* (Varian, 2003).

Letting the consumer have the option to choose which product one would like, Perloff (2004) claims that product variety could be handled better if one could point out exact the need of the consumers. Differentiation is desirable for the consumer in its way, notwithstanding that the price would rise and inflict the consumer with a higher cost of buying the product of desire. But the consumers value the fact that they could choose among different products, which might lead them to a new product even though it cost more.
In general, it would be tough to understand and to find the exact number of product verity. Like Hill and Jones (2014) argues how difficult it would be to find the optimal set of product variety since it would be very hard for the manufacturers to achieve and keep expected efficiency and to their unit cost at their lowest as possible. By having a differentiated product portfolio, it would have longer lead-time and would be almost impossible to achieve economic of scale, which implies it would cost more.

2.2.4 Customer service

To be able to have an efficient handling of the incoming rush orders, the customer service needs to be well structured, to be able to handle the demanded requests from the customers. In this part, there will be a focus on the customer service and after-sales service since Jets perceive handling of rush orders as a service to their customer.

In a logistical system, customer service is one of the most important components, because all the other logistic activities must be structured to support the firm's customer service objectives (Gourdin, 2006). Gourdin (2006) argues that a firm's customer service strategy is built around five key concepts:

1. Dependability
2. Time
3. Convenience
4. Communications

5. Honesty

- **Dependability** could be viewed from the customers' point of view as one of the most important concerns because it addresses very basic parts of the buying process. Dependability could be referred to product availability, meeting promised delivery dates, filling orders correctly, and providing accurate billing statements.
- **Time** is related to the order cycle, which refers to how long time it takes for the goods to be delivered after the order has been placed.
- **Convenience** refers to aspects like ordering accessibility, the frequency of sales calls, hours for pick-up and delivery, technical assistance, and after-sales service.
- **Communications** relate to activities such as answering customer inquiries, billing, cargo tracking, and information management.
- **Honesty** refers to that a company must keep its promises that are given to its customers. If customers are promised too much, and the company could not keep what they promised, customers will be dissatisfied. So one need to be careful not to exaggerate the service level.

It could also be difficult to know how much service should be offered. According to Gourdin (2006), the higher service level that is provided, the more costly it will be. Another factor he mentions that raises costs on customer service are the increasing level of demand. Given the limits of the available market, the demand will at some point not increase regardless of how much customer service that is provided.

To be able to figure out how much customer service that should be offered one need to be able to weigh up the cost of providing that service with revenues that it will result in (Gourdin, 2006). Gourdin (2006), argues that it will be extremely difficult to analyze how much customer service variables on sales, but Ellinger, Daugherty and Gustin (1997) indicate that the quality that the service a company provide could cause a company to gain or lose up to 10 percent of sales revenue. Furthermore, Gourdin (2006) argues that losing a customer could cost as much as eight times more than retaining one. Logistical performance could help gain and maintain profitable customers if it is properly exploited (Ellinger, Daugherty & Gustin, 1997).

To manage customer service for global companies is especially challenging because the customers are not equal and a firm cannot adopt a one-strategy-fits-all approach to customer service (Gourdin, 2006).
According to Tracey (1998), for manufacturers to be able to provide customer service, it is critical to be able to develop underlying capabilities. Two important capabilities are logistics efficiency and manufacturing flexibility.

2.2.5 After-sales service

After-sales services or aftermarket services have over time become a bountiful source of revenue and profit for many industries. The reason for this is because companies have over time sold so many units that their aftermarket has become up to four to five times larger than the original equipment business (Cohen & Agrawal, 2006). It is often the aftermarket- or after-sales department at companies that provide the service to the customer and help them when a spare part is needed.

Cohen and Agrawal (2006) argue that the after-sales services are a high-margin business and that it could account for a large part of corporate profits. After-sales service does also play a crucial part when it comes to customer loyalty since a lot of customers rate the after-sales service high.
But it is not only positive sides with the aftermarket, and a lot of companies find it difficult to manage after-sales. If one cannot provide the service efficiently, one cannot make any profit off it. Customers are also often unhappy with the quality of after-sales support because they do expect that manufacturers fix things quickly when they break down. Cohen and Agrawal (2006) highlights that the customer expectations have over the years escalated and they use an example from semiconductor manufacturers. In the 1980s, the manufacturers had a response time from their suppliers of two days if their equipment failed, while today the manufacturers expect their suppliers to respond within 15 minutes.

Further, Cohen and Agrawal (2006) argue how after-sales service supply chains are characteristic and that the network of resources consisting of: people (call center staff, engineers, depot and warehouse staff, and transportation staff), materials (parts) and infrastructure (for materials movement and storage, repair, transportation, communications and information systems), makes it possible to deliver the service products to the

customers. The after-sales service supply chain differs from the traditional manufacturing supply chain as illustrated in Figure 6.

PARAMETER	MANUFACTURING SUPPLY CHAIN	AFTER-SALES SERVICES SUPPLY CHAIN
Nature of demand	Predictable, can be forecast	Always unpredictable, sporadic
Required response	Standard, can be scheduled	ASAP (same day or next day)
Number of SKUs	Limited	15 to 20 times more
Product portfolio	Largely homogeneous	Always heterogeneous
Delivery network	Depends on nature of product; multiple networks necessary	Single network, capable of delivering different service products
Inventory management aim	Maximize velocity of resources	Pre-position resources
Reverse logistics	Doesn't handle	Handles return, repair, and disposal of failed components
Performance metric	Fill rate	Product availability (uptime)
Inventory turns (The more the better)	Six to 50 a year	One to four a year

Figure 6: Comparison of a manufacturing supply chain and an after-sales service supply chain (Cohen & Agrawal, 2006)

Both after-sales service supply chains and manufacturing supply chains differ in many ways although both consists of assets and entities linked by the flow of materials, information, and money. The services that the after-sales service provider, is not something that could be manufactured in advance of demand. When an irregular event such as a product failure happens and triggers a need, the manufacturer could manufacture such service.

Although some events are predictable for the after-sales departments such as scheduled maintenance, it is still difficult to forecast how many spare parts and engineers are needed for that. While at the product manufacturer, physical assets must be deployed in advance of events so that they can respond with speed promised to customers (Cohen & Agrawal, 2006).

2.3 Supply Structure

Jets have a supply structure combined with many different links, which will be presented by a theoretical description of what a supply chain is, and some key aspects.

Harrison and van Hoek (2008) define a supply chain as: *"A supply chain is a network of partners who collectively convert a basic commodity (upstream) into a finished product (downstream) that is valued by end-customers, and who manage returns at each stage"* (Harrison & van Hoek, 2008). In Figure 7, a supply chain network is illustrated with a focal company in the middle, which is connected with many possible suppliers and customers.

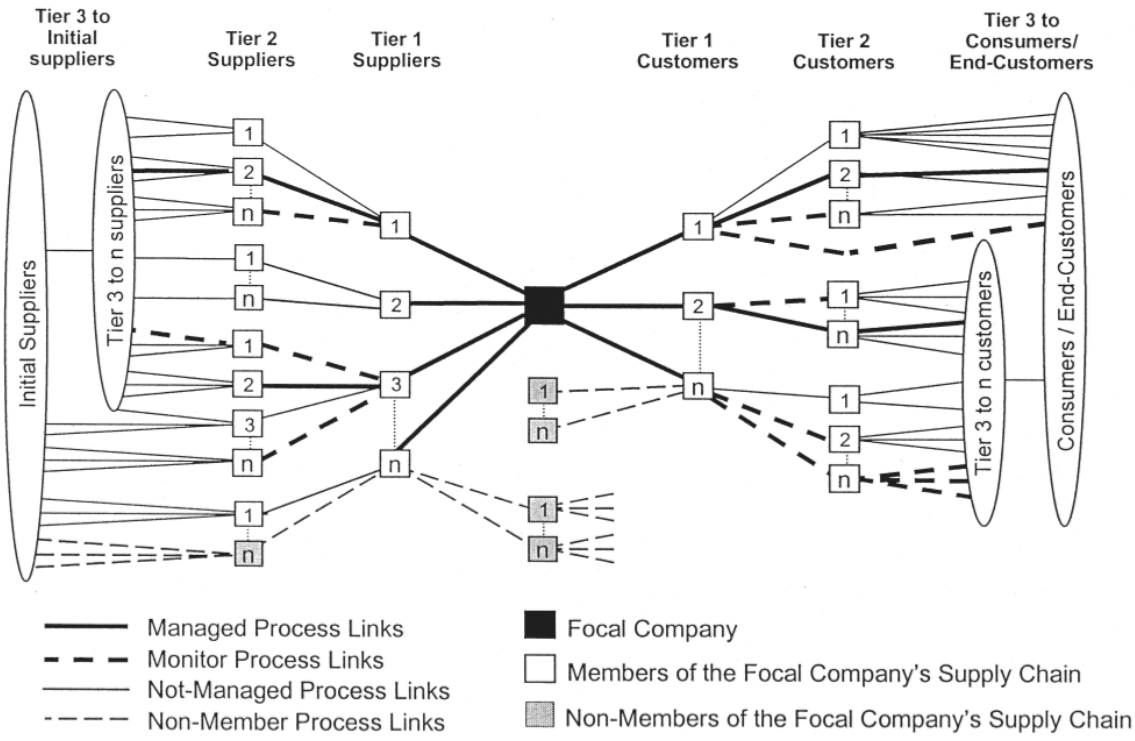

Figure 7: Supply Chain network structure (Lambert & Cooper, 2000)

When we go more in depth of the supply chain network that is illustrated in Figure 7, the focal firm is embedded within the chain. From there the operational processes within the focal firm must coordinate with others that are part of the same chain. On the left side of the chain is the upstream or "buy side" where materials flow, and initially will end up at the right side of the chain also called downstream or "supply side". Both the supply side and the demand side is tired up to a supply chain so that the sides can be organized into

groups of partners with which we deal (Harrison & van Hoek, 2008). In our case, the downstream part of the supply chain will be most focused on since the rush orders occur between Jets as the focal firm and the customers who place the rush orders.

Lambert and Cooper (2000) argues that integrating and managing all business process links throughout the whole supply chain is not likely suitable. The level of integration should differ from link to link and over time because the drivers for integration are situational and different from process link to process link. But some links are more critical than others and play a more vital role in the supply chain. Lambert and Cooper (2000) have come up with four different types of business process links that can be identified between members of the supply chain, which also is illustrated in Figure 7. The four links are the following:

- Managed process links – refers to links that the focal company finds important to integrate and manage.
- Monitored process links – refers to links that are not as critical to the focal company, but it is important for the focal company that those process links are integrated and managed properly between the other member companies.
- Not-managed process links – are process links that the focal company would not actively involve in. The links are also not critical enough to use resources for monitoring.
- Non-member process links – are the process links between the members of the focal company's supply chain and the non-members of the supply chain. The non-member process links could and often will affect the performance of the focal company and its supply chain, although the non-member process links are not considered as links of the focal company.

2.3.1 Importance of information flows in supply chains

A supply chain will not be fully functionally without a good information flow, and when customers place an order that is urgent, a good flow of information is crucial.

To create the best product flows, a continuous information flow is required. Because of fluctuation in customer demand, one need to process information both accurately and in a timely manner for a quick response. Being capable to manage the supply chain effective, one need to control the uncertainty from customer demand, the manufacturing process, and

the supplier performance (Lambert & Cooper, 2000). Singh (1996) concludes in his case study about the importance of information flow in the supply chain that one cannot achieve responsiveness to customer demand and overall customer satisfaction without proper management of both goods movement and information flow throughout the supply chain. Chopra and Meindl (2010) argue that information is crucial to make good supply chain decision regarding strategy, planning, and operations.

2.3.2 Efficient and responsive supply chain

It is essential for companies to find the correct supply chain strategy for their company. Chopra and Meindl (2010) suggest that to create a strategic fit is all about creating a supply chain strategy that best meets the customer's needs and demands regarding the uncertain environment that the company operates in. There are two main focuses when developing such strategy, and companies need to find out if their supply chain should focus primarily on being efficient or being responsive. There will always be a trade-off between cost and responsiveness, and companies need to make a strategic choice regarding the level of responsiveness they seek to provide.

The primary goal for an efficient supply chain is to get the supply demand at the lowest cost as possible, which influence the level of responsiveness. Companies with efficient supply chains offer little variety and little flexibility. A highly efficient supply chain has product scheduled weeks or months in advance and there are very little variety and flexibility. An efficient supply chain could be characterized as a make-to-stock manufacturer with a production lead-time of several weeks (Chopra & Meindl, 2010).

The opposite of an efficient supply chain is a responsive supply chain, which has a primary goal to respond quickly to demand. Chopra and Meindl (2010), argues that supply chain responsiveness includes the ability of:

- Respond to wide ranges of demand quantities
- Meet short lead times
- Handle a large variety of products
- Build highly innovative products
- Meet a high service level
- Handle supply chain uncertainty

A responsive supply chain needs to have low response time and flexibility in the manufacturing process, because of the production of make-to-order products or custom-made products in small batches. A highly responsive supply chain could be able to change the product availability (merchandise mix) by location and time of day. A responsive supply chain could be described as delivering a large variety of products in a couple of weeks. Regarding costs, responsive supply chains are far more costly than an efficient supply chain. The higher responsiveness, the higher costs (Chopra & Meindl, 2010).

Fisher (1997) compare an efficient and a responsive supply chain and have provided a list of some of the major differences, which is illustrated in Figure 8 below.

	Efficient Supply Chains	**Responsive Supply Chains**
Primary goal	Supply demand at the lowest cost	Respond quickly to demand
Manufacturing focus	Maximize performance at a minimum product cost	Create modularity to allow postponement of product differentiation
Pricing strategy	Lower margin because price is a prime customer drive	Higher margins because price is not a prime customer drive
Manufacturing strategy	Lower cost through high utilization	Maintain capacity flexibility to buffer against demand/supply uncertainty
Inventory strategy	Minimize inventory to lower cost	Maintain buffer inventory to deal with demand/supply uncertainty
Lead time strategy	Reduce, but not at the expense of cost	Reduce aggressively, even if the costs are significant
Supplier strategy	Select based on cost and quality	Select based on speed, flexibility, reliability, and quality

Figure 8: Comparison of an efficient and a responsive supply chain (Fisher, 1997)

2.4 Segmentation

Jets have divided their logistical operations into two main segments land & transport and ship & offshore (see 4.1), to better control their supply chain, but to also make it easier to distinguish each market they operate in. To make sure they serve the right need to the right segment. Nevertheless, to better understand what it means to segment, one would need to look at what the literature says, and how the various segments are affected by rush orders differently. Armstrong and Kotler (2005) defines segmentation as *"Dividing the market into distinct groups of buyers with different needs, characteristics or behavior, who might require separate products or marketing mixes"* (Armstrong & Kotler, 2005). Armstrong and Kotler (2005) argues that the new concept of segmentation to be market segmentation, which means that the company is adopting to match the needs of one or more segments, which also have little competition or good prospects. They have realized that the customers are different, and one need to adopt, that it is appealing to one customer group, but for another one, it might not be as appealing. This means that the customer has different needs and has different purchasing behavior, which is very relevant to the situation at Jets. Armstrong and Kotler (2015) argues that the advantages for market segmentation are that one could focus on the segment that the company could satisfy the most, which means Jets could choose between their two main segments to have their primary focus on.

2.5 Cause, effect and solution model

To sum up this literature review, we have developed a model (Figure 9) such as the model Wang and Chen (2008) (Figure in chapter 1.2) had made, but we have added what effects rush orders could have and not only the causes and solutions. The causes, effects and solutions are derived from the literature that has been reviewed in this chapter.

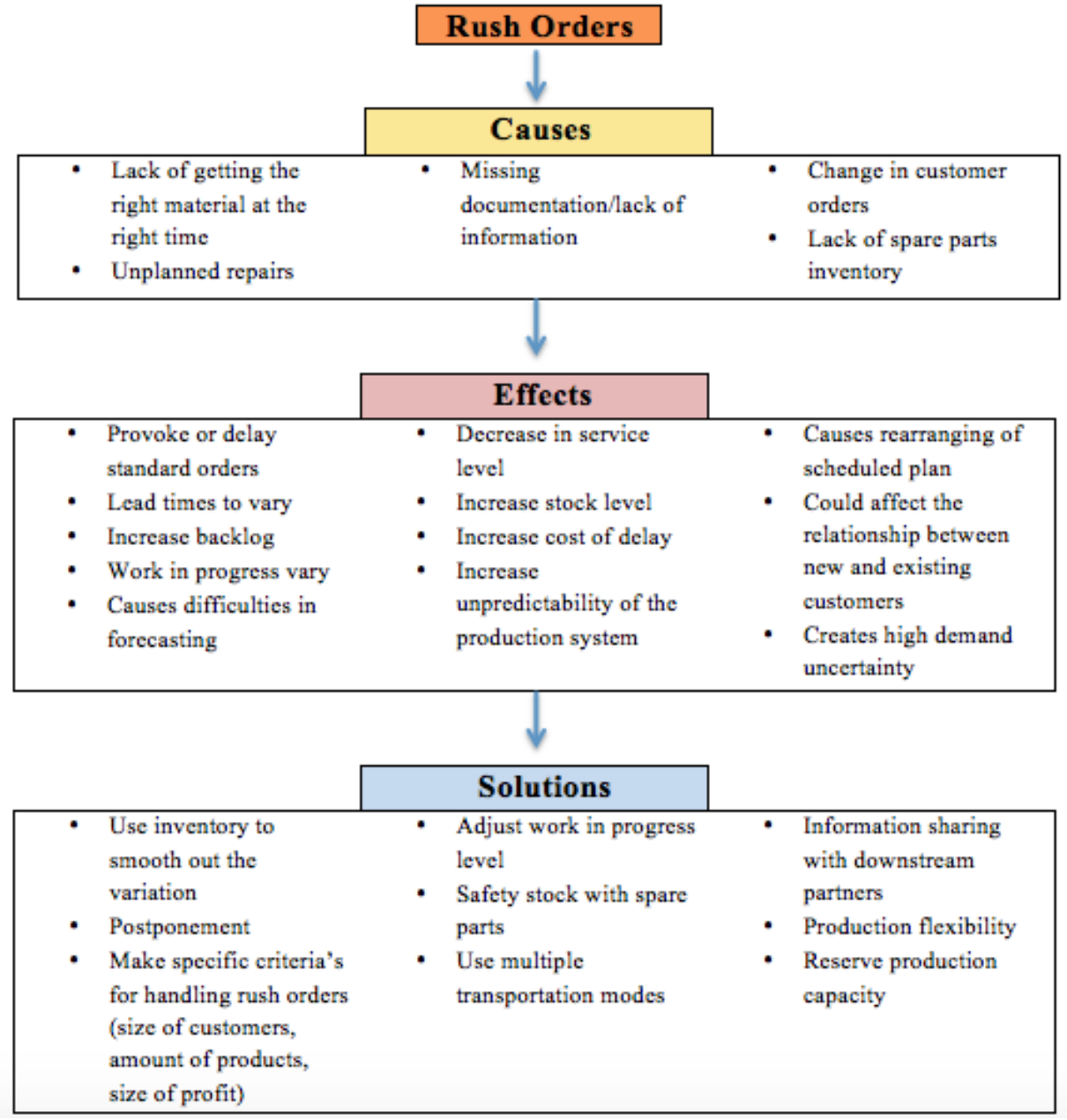

Figure 9: Causes, effects, and solutions model (Pettersen & Saunes, 2017)

2.6 Research problem

As mentioned in the introduction for this literature review, the literature that has been reviewed will serve as the frame of references to the subject studied. The literature that has been reviewed in this chapter will be used later on in the analysis, which will give answers to our research questions. Our research questions in this thesis will help us provide an answer to our research problem (see 1.4). These questions have been revised during the literature and data collection that have been done throughout this thesis, to make sure that we answer what we seek to find. We have ended up with three research questions that we find suitable for answering the research problem:

RQ 1: What are the main causes for rush order to appear at Jets?
We would try seek our answer to this research question by performing interviews with key informants who is directly involved with rush orders, by finding the actual problem of how rush orders appear, and where? It would be important to find what causes the rush orders to able to establish a common ground for understanding of the problem.

RQ 2: What effect does rush orders have on Jets?
Here we want to look at what impact does rush orders have on Jets by explaining the effects the rush orders have.

RQ 3: What solutions can be applied to reduce the amount of rush orders and ease the effects rush orders have on Jets?
Here we want to look at what actions that might be taken to prevent a rush order from occurring and what can be done to ease the effects rush orders have on Jets.

3.0 Research methodology

In this chapter, the research methodology used for our thesis would be described by introducing our research strategy, how we design our research, the research method, and how we collected our data. Lastly, this chapter ends with some criteria's for judging the quality of a case study as a research design.

3.1 Research strategy

Byram and Bell (2015) argues that quantitative and qualitative research is two of the main research strategies. Quantitative research is a research strategy that emphasizes quantification in the collection and analysis of data. Qualitative research is referred to as a research strategy that usually emphasizes words rather than quantification in the collection and analysis of data (Byram & Bell, 2015).

In this thesis, we are using a qualitative strategy. Since the data for conducting this research is vague, that it lack of clear data on why rush orders occur and what effects they have, Silverman (2006) state that the use of qualitative research to be more reliable than quantitative research. The definition that one could use for understanding the meaning of what it means by conducting a qualitative research could be as following; *"…any kind of research that produces findings not arrived by means of statistical procedures or other means of quantification"* (Straus & Corbin, 1990). In other words, it means that the primary focus of performing a qualitative research would be to get a clear understanding of arguments, decisions and knowledge's, rather than numbers in itself. The main understanding of conducting a qualitative research is that it is more interested in the individual than in general level (Mayring, 2003).

3.2 Research Design

Yin (2003), defines the research design as: *"…the design is the logical sequence that connects the empirical data to a study's initial research questions and, ultimately, to its conclusion"* (Yin, 2003). One could use many different research designs, and Byram and Bell (2015) discusses five types of designs: cross-sectional design, experimental design, longitudinal design, comparative design and case study design. Out of these five, we have chosen case study as our research design.

3.2.1 Case study

The use of a case study as a design is generally used when there is a complicated social phenomenon that is needed to be understood, and when there are unanswered questions that have not been thoroughly researched (McCutcheon & Meredith 1993). In our case, Jets have a problem of rush orders that has not been investigated yet. If the case study is properly conducted one could find new and valuable information about the study carried out and lead to progress of finding new theory that has high validity (Voss, Tsikriktsis & Frohlich, 2002). In this thesis, we have chosen an explanatory way of approaching the case study.

When designing a case study, one can use a single-case design or a multiple-case design. Whether one should look at one case or many cases is the main difference between a single-case and a multiple-case. Since we have located the problem at one specific company, Jets, a single-case approach suits us best and it would give us the necessity that is needed to make a proper conclusion.

3.2.1.1 Single case

A single-case study can be a case such as a single corporation, a single location, a single person, or a single event. However, it is important to distinguish between holistic case study and embedded case study. A holistic case study means that it involves a single unit of analysis, like having a unique or extreme case. On the other hand, embedded case study involves more than one unit of analysis and one need to look at subunits, like looking at one unique or extreme case, but now wants to understand the different choices within the single case (Baxter & Jack, 2008).

Out of what has been mention above, we feel that embedded single-case study design would fit our case study. Our analysis would concentrate on one corporation, Jets, where the subunit used in our case would be different departments within Jets (aftermarket, service, warehouse, production, export, etc.), and dealerships and Jets representatives. At first, we would look at each department and analyze how each department is operating and how they are affected by an incoming rush order, at subunit level. We would also pick out dealerships and representatives that are involved with the rush orders. From there we would perform interviews with each of the selected departments, dealerships, and

representatives that we feel would be representative for our case study, and further we would draw a conclusion out of our analysis. This gives us the opportunity to consider the trends that causes rush orders to arise, what effects do they have on Jets, and it would enable us to promote possible actions to reduce the number of rush orders and to ease the effects rush orders have on Jets.

3.3 Research method

Within a case study, one can use a range of different methods for gathering and analyzing data. The different methods could be methods such as observations, diaries, questionnaires, tests, statistics, interviews, etc. The most important thing to think about when choosing method(s) is to choose the method(s) that is best in terms of answering the questions that arise (Thomas, 2011).

3.3.1 Interviews

A method that we found is most suited for answering our questions is to interview employees at Jets that have experienced such rush orders and could provide us with their knowledge and expertise. These employees will be key informants for our research. It will be important to find the key informants that have experienced different cases of rush orders, so that we can get a broader view of the problem we want to research.

According to Thomas (2011), there are three different structures to design interviews:

- Structured interviews – is interviews with another person where you ask the person a predetermined list of questions. The structured interviews have some strengths and weaknesses. The strength of the structured interviews is that it could be administrated relatively easily and quickly and the answers could easily be coded. The weaknesses of the structured interviews are that it doesn't have a great advantage in giving the interview in a face-to-face manner. The reason for this is that the interview questions could as well have been given in written form, which makes it more as a questionnaire.
- Unstructured interview – is an interview that will likely be used in an interpretative case study, and an unstructured interview is like a conversation. With an unstructured interview, you do not present a list of questions to the interviewees and there is no fixed way to conduct such interviews.

- Semi-structured interviews – is interviews that is a combination of structured and unstructured interviews. You will provide a structure with a list of issues (rather than specific questions) to be covered and there will be freedom to follow up points as necessary.

Of the three different interview designs, the semi-structured interviews are the design that will fit us the best. The semi-structured interviews fit us because we will provide a structured list of issues, rather than specific questions, and we want to have freedom to be able to follow up points as necessary. Not all the interviewees may interpret the issues the same, and therefore it would be appropriate to have some freedom to follow up points or describe the issues in another way.

3.4 Collection of empirical data

3.4.1 Company visit and interviews

We visited Jets on the 19th of January in 2017 where we conducted a semi-structured interview in Norwegian with six different employees. The interview guide we used can be found in the appendix (see 11.1), and the interview lasted in total around 2 hours and 30 minutes. Our contact person at Jets, the former production manager who now serves as the site manager, had arranged the interview for us and gathered employees that were involved with rush orders. The employees our contact person had gathered are presented in Figure 10.

Position in Jets	Duration
Production Manager/Site Manager	2 hours and 30 minutes
Chief Operating Officer (COO)	1 hour and 25 minutes
Manager Aftersales & Export	1 hour and 35 minutes
Sales Assistant - Land & Transport	1 hour and 35 minutes
Sales Assistant - Land & Transport	1 hour and 35 minutes
Export Coordinator	1 hour and 35 minutes

Figure 10: Overview of interviewees at Jets

Our contact person was present throughout the whole interview, while the COO was present during the first 1 hour and 25 minutes, while the rest was interviewed of the remaining 1 hour and 35 minutes. The reason for why the interview was not conducted with each employee alone was because of the busy schedule the different employees had. We felt that we got many good and relevant feedbacks, and since this became a group interview, we felt that the interviewees complemented each other very well. Another positive thing with a group interview was that the interviewees did not repeat themselves that much and they did not overlap their responses, which could have happened if we had interviewed them individually. Another positive thing was that the interviewees discussed among themselves during the interview and it was easy for them to get confirmation from the others when they used an example or described something. We also felt that the interviewees had a very good tone among themselves and they were not afraid to help or correct each other during the interview.

After the interview, our contact person took us out to the production- and warehouse department where we observed how the production was performed. Our contact person also showed some of the products that had been discussed during the interview so that we could get a clearer picture of what they had been talking about.

3.4.2 Interviews with dealerships and Jets representatives

The interviews with the dealerships that sell Jets systems and representatives was conducted through email. The reason for why these interviews were conducted through email and the limitations with interviewing through email are described in chapter 8.0. We offered the dealerships and representatives to answer the questions through phone or Skype, but we got in response that they rather wanted to respond the questions through email because they then could respond to questions when they had time. The dealerships and representatives received other questions than the employees at Jets because some of the questions were more appropriate to ask the employees at Jets rather than the dealerships and representatives. The employees at Jets helped us out with choosing dealerships and representatives that were often involved with rush orders, and they helped us to come in touch with them. Before sending out the questions, our contact person at Jets read through the questions to verify some of the questions that had details about Jets in them, but also to verify that the questions did not create any bad relations between Jets and

the interviewees. An overview of the interviewed dealerships and representatives are illustrated in Figure 11.

Name	Dealership or representative	Segment	Country
Bryne Rør AS	Dealership	Land & Transport	Norway
Hallingdal Varme & Sanitær AS	Dealership	Land & Transport	Norway
Hønefoss VVS AS	Dealership	Land & Transport	Norway
Tempe VVS AS	Dealership	Land & Transport	Norway
Technique Marine Service	Representative	Ship & Offshore	Singapore
Ms/Technology Ventures Middle East FZC	Representative	Ship & Offshore	United Arab Emirates
Technava S.A.	Representative	Ship & Offshore	Greece

Figure 11: Overview of interviewed dealerships and representatives

3.5 Testing the research design

Yin (2003) has in his book come up with some criteria's for judging the quality of a case study as a research design. By using Yin's (2003) research criteria's, it will help us to be able to ensure the scientific value of our study.

3.5.1 Construct validity

Construct validity refers to as establishing correct operational measures for the concept being studied (Yin, 2003). To be able to increase the construct validity, Yin (2003) propose three tactics. The first tactic (1), he recommends using multiple sources of evidence. In this research, we have used multiple sources regarding interviewing different employees at Jets, different dealerships, and different representatives. The second tactic (2), recommends establishing a chain of evidence. This means that an external observer should be able to follow the derivation of any indication from the primary research question to the conclusion of the case study. We hope to achieve a chain of evidence by having a clear structure in our thesis. The last tactic (3), he recommends having key

informants review the case study report. Here we use the feedback we get from our supervisor, but also our contact person at Jets reviews information about Jets.

3.5.2 Internal validity

Internal validity refers to as establishing a causal relationship, whereby certain conditions are believed to lead to other conditions. To be able to have internal validity, one can achieve that through general analysis strategies such as explanation building, pattern matching, addressing rival explanations, and by using logic models (Yin, 2003). We have addressed rival explanations through asking the same questions to employees at Jets, dealerships and representatives. Out of this, we have examined their rival explanations.

3.5.3 External validity

External validity deals with the problem of understanding if whether a study's findings are generalizable beyond the immediate case study (Yin, 2003). Since there haven't been carried out any research on rush orders at Jets before, which operates within the sanitary system industry, we cannot conclude that our findings can be applied to other companies within the same industry or to other industries. In other words, it's hard to generalize these findings. The findings can be generalized if one conducts this case study within another company in the sanitary system industry, preferably a company that operates with vacuum systems and one end up with the same findings.

3.5.4 Reliability

Reliability refers to as demonstrating that if one at a later point conducts the same case study as described in this master thesis one will end up with the same results. The goal of this test is to minimize the errors and biases in the study. One can use two tactics for increasing reliability; the first one is to use a case study protocol, which deals with the problem of documentation. The second one is to develop a case study database (Yin, 2003).

Through our proposal paper, we created a simplified study protocol. In that paper, the title, problem description, research questions, problem statement, and a timeline for our planned master thesis were presented. In our proposal, we had a plan of whom we may want to interview, but we were not sure at that point if it were possible to interview everyone.

A case study database refers to as the way of organizing and documenting the data collected for case studies. We have stored digitally the audio file and the transcript from our interview with employees at Jets, the excel spreadsheet with all the orders placed with Jets in 2016, and all the answers we have received from dealerships and representatives.

4.0 Company presentation

Jets Vacuum AS was founded in 1986 by Olav Hofseth and is located in Hareid in Møre & Romsdal, Norway (see Figure 12). The company has grown into becoming a worldwide organization with production both in Norway and globally in countries such as Latvia, Germany, and China. Jets Vacuum is producing and offering advanced sanitary systems for both onshore and offshore installations. Jets were in 2014 handed the Norwegian export price (Myrene, 2014).

Figure 12: Location of Jets in Norway (Google, 2017)

4.1 The segments Jets operate in

Jets have two main segments they operate in, and these main segments are the ship & offshore segment and the land & transport segment. These main segments are combined of several different segments as illustrated in Figure 13. Research, other, and internal sales are segments that have been placed within the main segment "Others", because they are

more general and includes both in the ship & offshore segment and in the land & transport segment.

Ship & Offshore	Land & Transport	Others
Bulk & Cargo	Cabins & Homes	Research
Cruise	Train	Other
Ferry	Discharge Station	Internal Sales
Fishing	Building	
Offshore Prod.	Mobile Solutions	
Navy	Bus	
Offshore Supply	Supermarket	
Tanker	Outdoor	
Yacht	Land and Transport	
Ropax		
Fast Ferry		

Figure 13: Overview of the segments Jets operates in

4.2 Description of Jets' vacuum sanitary system

The difference between a traditional sanitary system that use gravity and a vacuum sanitary system is that the vacuum sanitary system use air instead of water to transport human waste. Only a small amount of water is used to clean the bowl in a vacuum system. Jets are operating with two different designs for their vacuum sanitary systems:

- **Constant vacuum system (CVS)** – is a system that suits best for larger ships and buildings. It is also possible to add more toilets to the system, and the system could also be expanded later on for a larger capacity. In this system there is constant vacuum level, normally between 35% and 50%.
- **Vacuum on demand (VOD)** – is a smaller system that has a capacity of up to 4 toilets. This system produce vacuum only at the moment the toilet needs to be flushed.

A typical sanitary system from Jets consists of a toilet that are connected to a Vacuumarator pump, which are then connected to either a collection tank, bio tank, biogas plant, treatment plant or to the public sewage as illustrated in Figure 14.

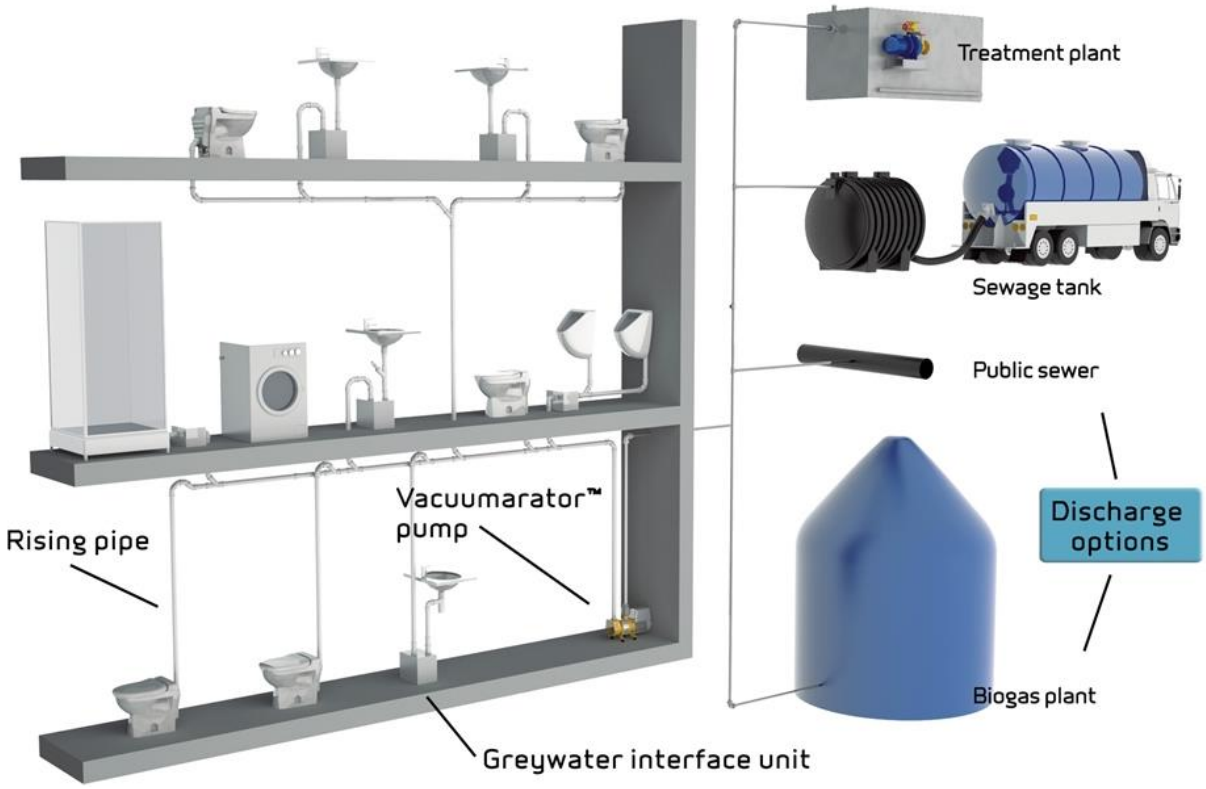

Figure 14: Overview of how a sanitary system is set up (Jets Vacuum, 2017)

What has made Jets so big on the market is their patented Vacuumarator pump technology (see Figure 11), which could be described as the heart of the sanitary system. The founder Olav Hofseth invented the pump and the pumps are highly efficient and compact vacuum pumps with integrated macerators that grind sewage into tiny particles.

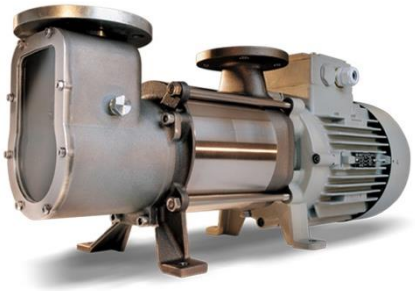

Figure 15: Vacuumarator pump (Jets Vacuum, 2017)

The Vacuumarator pump only uses around 1 liter per flushing versus approximately 8 liters with a normal gravity toilet. With this big difference in use of water, make the Jets sanitary systems more environmentally friendly and more cost efficient in countries or on installations where there are a shortage in water and/or where one need to pay for every liter of water one uses (Jets Vacuum, 2017). The benefits of using a vacuum system versus a gravity system are described in Figure 16.

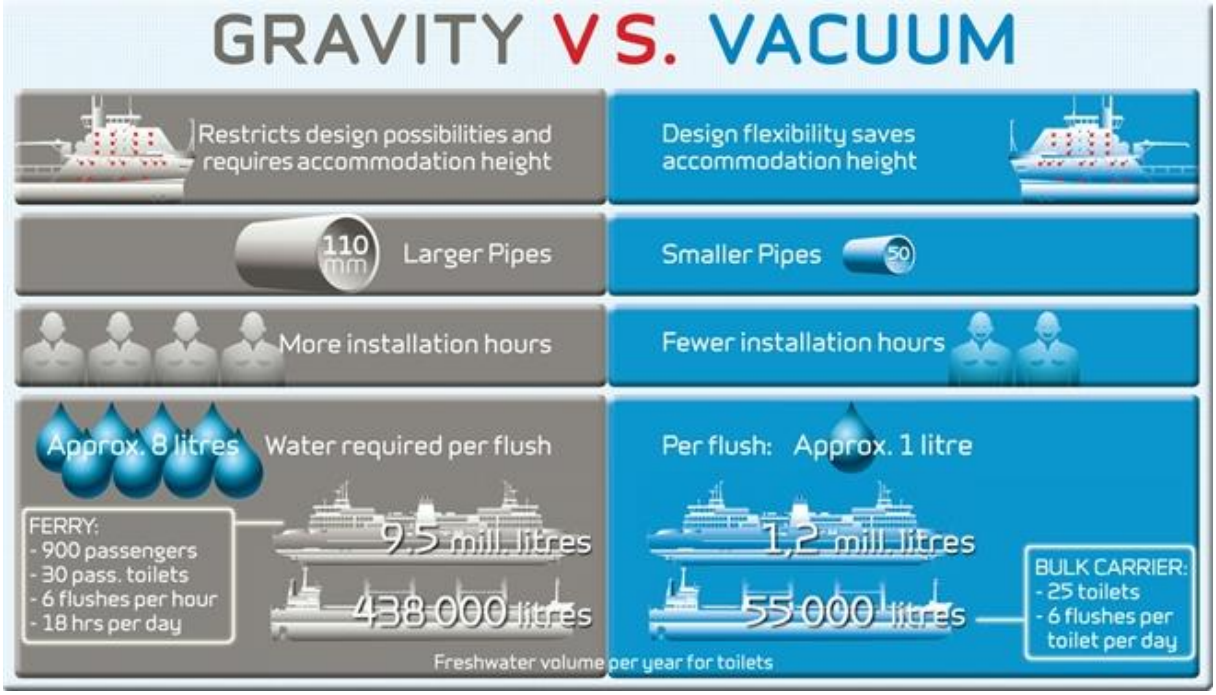

Figure 16: Gravity system versus a vacuum system (Jets Vacuum, 2017)

There are international standards that Jets have to achieve for their systems:

- Toilets should have the capacity to handle peak periods when they are used by 67% of users within one hour
- The average person uses a toilet 6 times a day
- One public toilet allows up to 15 visits per hour
- Urinals, allow up to 60 visits per hour

Therefore, must the capacity on the sanitary systems be able to fulfill these standards.

Figure 17: Different models of the Vacuumarator pump (Jets Vacuum, 2017)

Figure 17 illustrates different models of the Vacuumarator pump. The 10NT pump is the smallest pump available with a capacity of 100 flushes an hour. The 750NT pump is the largest pump with a capacity of 7500 flushes an hour. But the pumps can also be combined so that the system has a limitless capacity of flushes an hour.

4.3 Representatives and dealerships

Not all end users go directly to Jets when they place an order or have other inquirers. Jets have a global network of representatives, which are divided into the ship & offshore- and land & transportation segments and some of the representatives support both segments. The representatives are the link between the end users and Jets and these representatives are brought to Norway for product training so that the customer can get assistance all over the world.

Figure 18: Overview of the 29 Jets representatives for the ship & offshore segment (Jets Vacuum, 2017)

Figure 18 illustrates an overview of all the 29 representatives Jets have for the ship & offshore segment worldwide.

Figure 19: Overview of the 16 Jets representatives for the land & transportation segment (Jets, Vacuum, 2017)

Figure 19 illustrates an overview of all the 16 representatives Jets have for the land & transportation segment worldwide.

There are also dealerships that have the same task as the representatives as being the link between the end users and Jets. There are 87 dealerships in Norway that has Jets systems in their assortment, were 85 of the dealerships are dealing only with systems within the cabin segment and the remaining 2 are dealing with both the cabin- and the building segment. Jets use these dealerships to promote and sell their systems through the dealerships and the dealerships also assist the customer with getting spare parts and other inquires. These dealerships are usually stores that deal with sanitary systems and plumbing or equipment to cabins.

Figure 20: Overview of the 87 dealerships in Norway dealing with Jets systems (Jets Vacuum, 2017)

Figure 20 illustrates an overview of the 87 dealerships in Norway. Customers outside of Norway can use the representatives within the land & transportation segment illustrated in Figure 19.

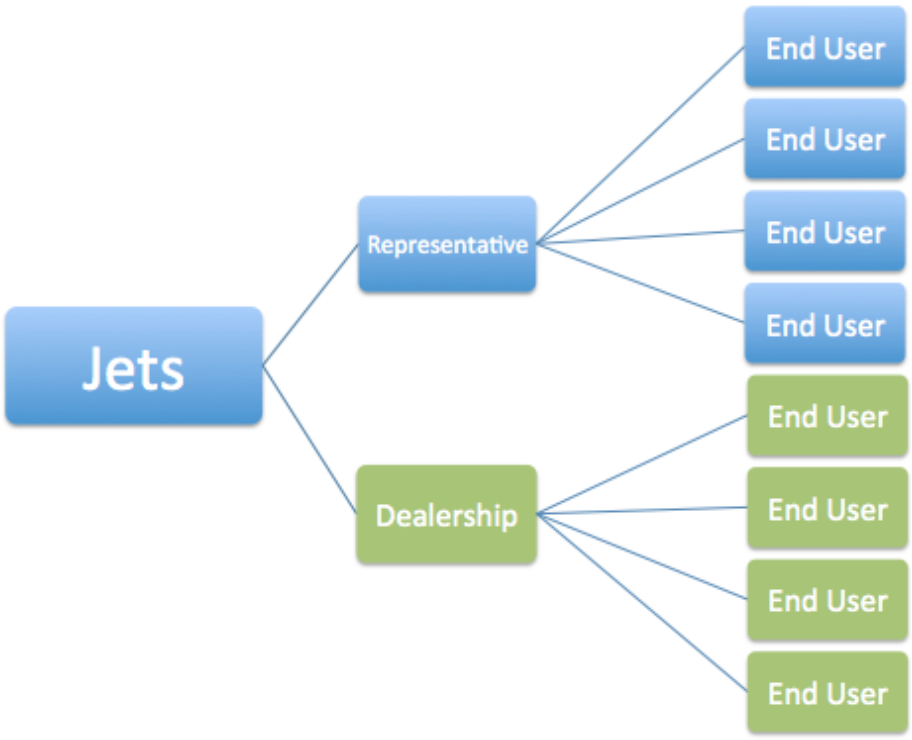

Figure 21: Supply structure between Jets and their dealerships and representatives

Figure 21 illustrates a simplified overview of the supply structure between Jets and their end users when they go through dealerships and representatives.

5.0 Empirical findings

In this chapter, we present our empirical findings based on our interviews with six employees at Jets, 4 dealerships, 3 representatives, and additional documents from Jets. A more detailed description about how we collected our empirical data is described in section 3.4. The first part of this chapter will be findings we got from interviewing employees at Jets. The second part will be empirical findings we got from interviewing dealerships and representatives.

5.1 Overview of rush orders at Jets

Jets do not have a clear definition on what they classify as rush orders, and have perceived it as a service they have provided to their customers. But in this case, they have defined a rush order based on the days from an order is created to the finish date of the order. All the orders that have 0 days from an order are created to the finish date (packed and shipped the same day, see 5.2.1), is categorized as a rush order in this case. Out of 8506 orders that were finished in 2016, 682 of these orders were rush orders based on the definition of what a rush order is given from Jets (around 8% of the orders). The customers, representatives, and dealerships that place these rush orders, usually contacts the sales department or the aftersales department at Jets when they place such orders.

If we take a closer a look at these rush orders, the total invoice amount of them represented 1,55% of the total invoice amount in 2016. Out of the 682 rush orders, 507 of them had a delivery address in Norway; the remaining 175 rush orders had a delivery address outside of Norway. Not all of the orders that were delivered in Norway would have final destination in Norway, since some of the orders had for example delivery address to airports and would from there be shipped outside of Norway.

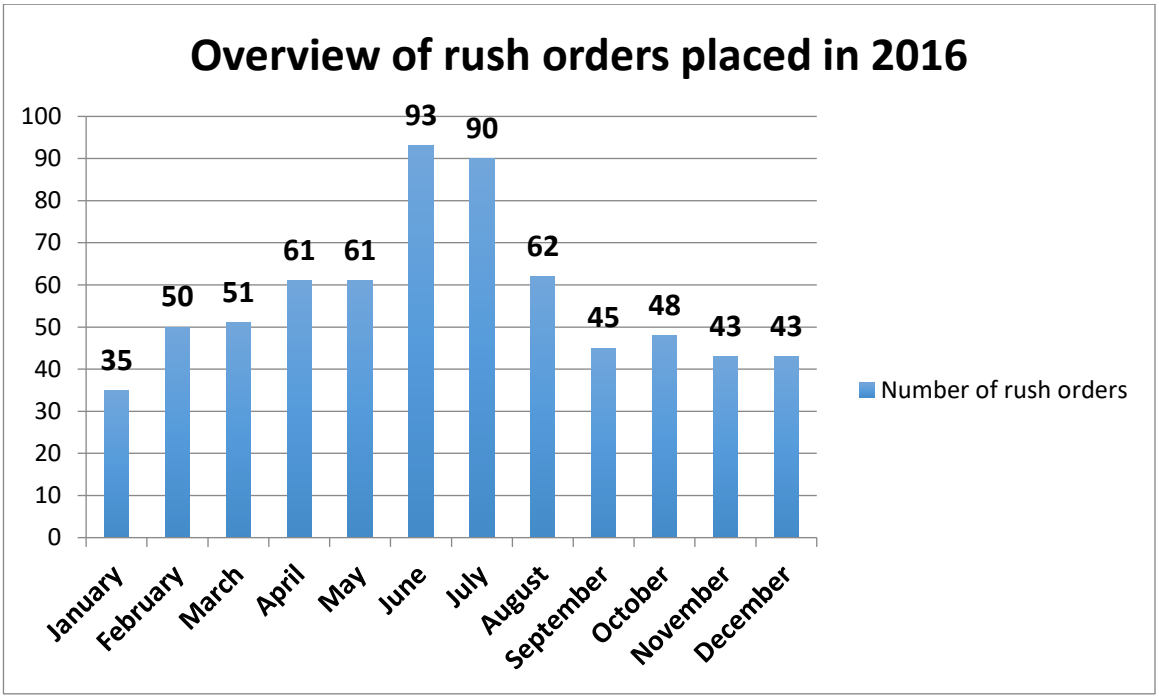

Figure 22: Overview of rush orders placed in 2016

From Figure 22 above one can see an overview of the rush orders placed in 2016. One can clearly see that the summer months June and July are the months with the most rush orders. The reason for that is because the customers from the main segment land & transport place more rush orders that month, especially the customers from the segment cabins & homes. The land & transport segment has a lot of rush orders in the summer because the demand in these months are high since the customers tend to use the summer months to install and maintain their sanitary systems in that period. Some reasons for why the customers do that is because of the spare time they have due to the summer holiday and since it is easier to install a system due to weather conditions.

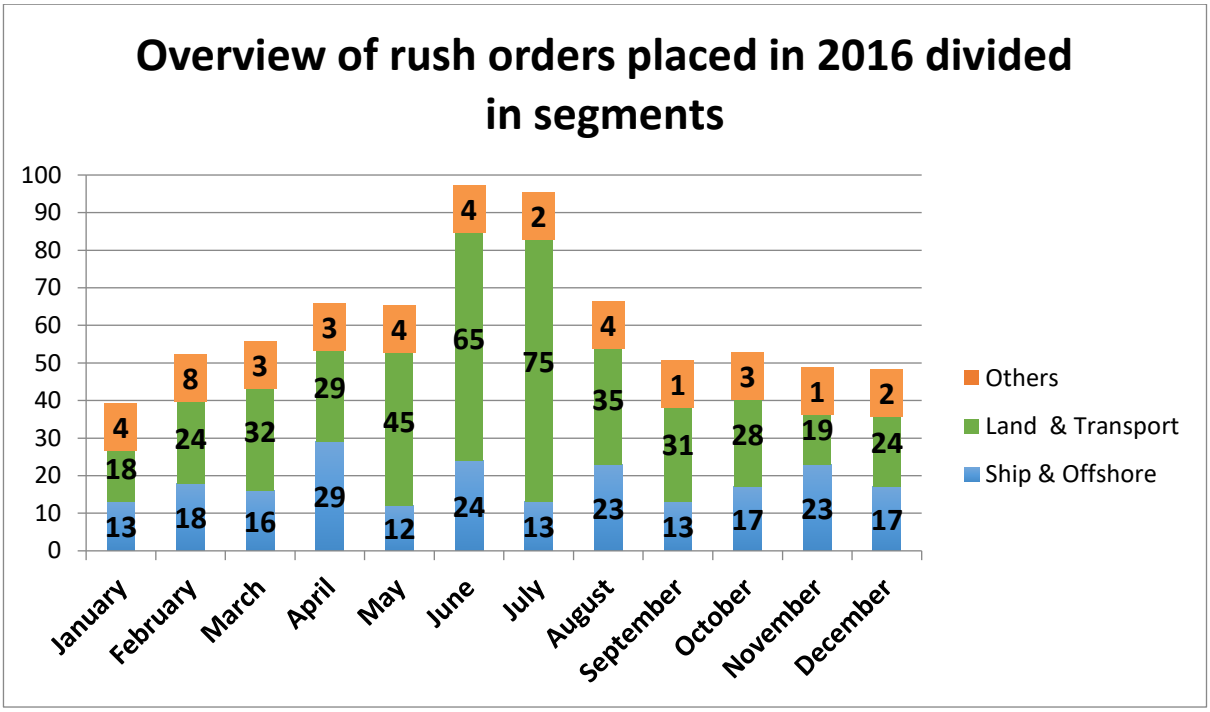

Figure 23: Overview of rush orders placed in 2016 divided in segments

In Figure 23 one can see an overview of rush orders placed in 2016 divided into the main segments, which are described in chapter 4.1. One can clearly see that the summer months are dominated by the land & transport segment as mentioned earlier. The other two segments are fairly spread out over the year.

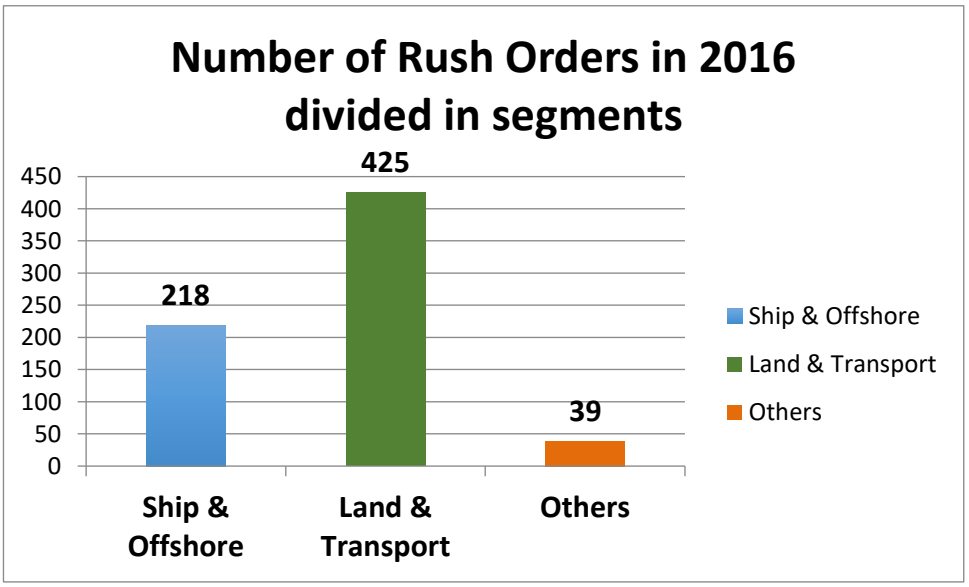

Figure 24: Number of rush orders in 2016 divided in segments

The total number of rush orders in 2016 has been divided into the main segments as illustrated in Figure 24. One can clearly see that the land & transport segment has the most placed amount of rush orders in 2016 with 425 rush orders.

5.2 Handling rush orders at Jets

When it comes to the handling of rush orders at Jets, the main difference from handling a standard order from a rush order at Jets is the time from the order is registered, packed and shipped. There is also a difference when it comes to handling an order regarding a production and an order regarding spare parts.

> *It is very important to separate production orders and spare part orders, since the spare part orders have a specific number of hours when it should be delivered. At Jets we got approximately 90% of all orders are spare parts, which should be delivered within 48 hours. This makes it very difficult to run it smoothly during a whole year.*

5.2.1 Handling rush orders regarding spare parts

The orders with spare parts are also those orders that dominate the rush orders (Figure 2), and the standard handling procedure for a spare part is illustrated in Figure 25 below.

Figure 25: Standard procedure for handling an order regarding spare parts

Figure 25 illustrate the standard procedure at Jets for handling an order regarding spare parts. When a customer/dealership/representative places an order, the order is first registered, then the next day the order is packed, and the day after that the order is shipped from Jets. The customer usually places the order by e-mail and Jets have a standard that they shall answer the inquiry within 48 hours.

> *An example could be that we get an order from a customer by e-mail on a Monday*

and we are in meetings that Monday and have a lot of e-mails and we do not manage to finish all the e-mail. The next day we do not manage to finish all the e-mails that day either. But then on Wednesday we made it, and then it has gone two days and we have to respond. Then we have to register the order in on Thursday and send it Friday. So then, the order came in on Monday and we do not send it before on Friday. So it has become such a habit I think with all at the after-market department that automatically if nothing stops them, they put the order into packing the next day and ship it the following day.

One must also check the stock to see if the part is available, but also with the warehouse department, and with the shipping department when handling an order. This because the warehouse department must have the capacity to pack the shipment and one need to be sure with the shipping department that the shipment will manage to arrive within requested time.

If a customer place an order for their ship in Singapore and the ship will leave Singapore on a specific date, it is important to be able to send the spare parts to the customer within that date. If we see that the parts can arrive within that date, but it is not 100% sure it will, we do not take the chance on it and we ask the customer to tell the next destination for the ship. Because we have no intention to send the goods to Singapore, and then miss the ship because it have left Singapore, and then we have to start a new process of sending it to another destination from Singapore.

The standard procedure has been developed over the years because of the increasing amounts of incoming orders and an increased number of steps the order has to go through to be finished. For ten years ago, it would be manageable to pack and ship the orders the same day. Now only the orders that are the most urgent ones, the rush orders, will be packed and shipped the same day and they are registered with 0 days from the order is registered to finish date. This is mainly the difference between a standard order and a rush order.

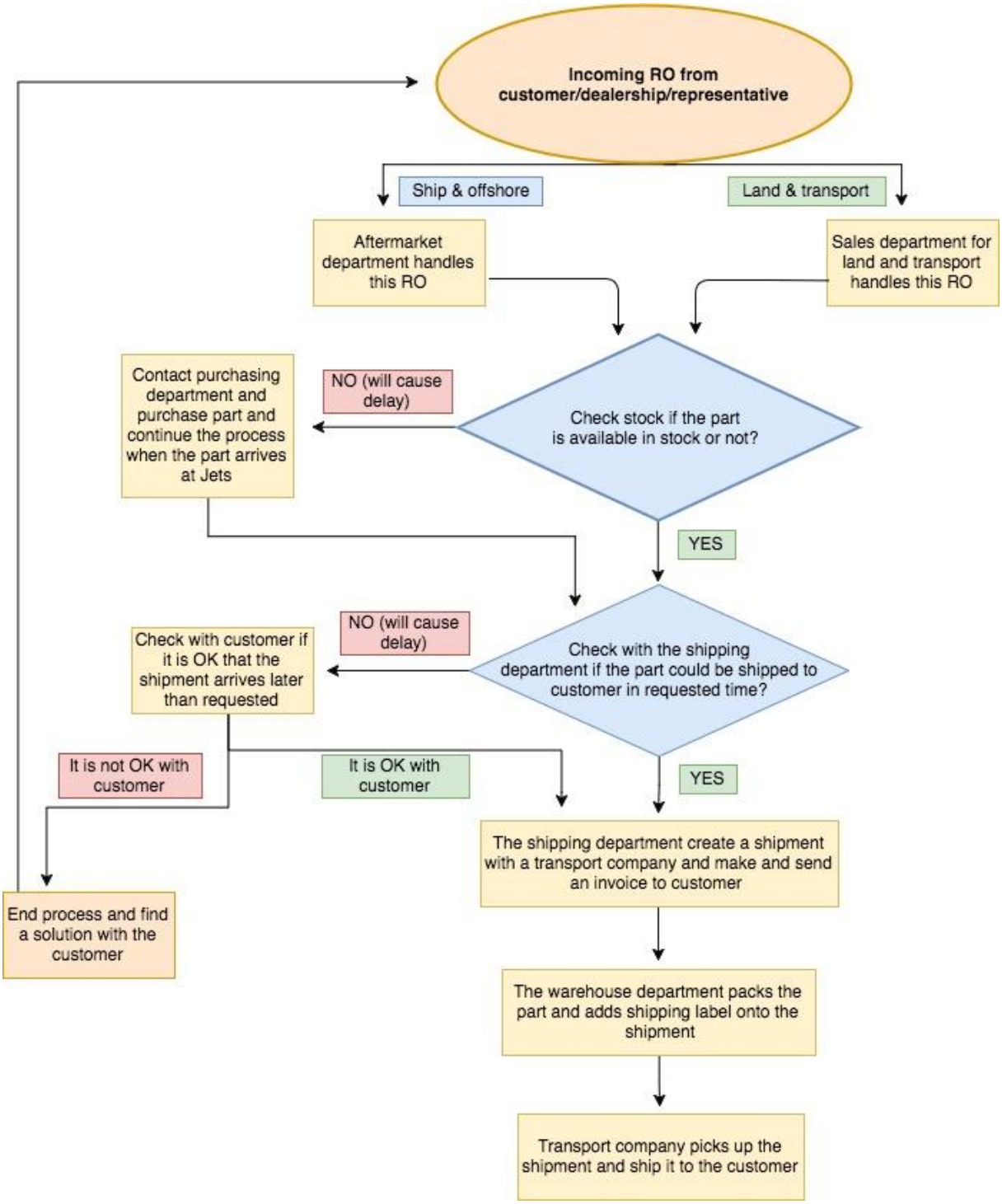

Figure 26: Overview of how a rush order regarding spare parts is handled by Jets

Figure 26 illustrates a simplified illustration of all the steps in the handling process of an incoming rush order (RO) for spare parts and all the different departments that are involved. When a rush order comes in, the customer/dealership/representative often calls Jets, because the employees at Jets have over time developed some knowledge about those who place the orders and when they call it is often something urgent. The first step

illustrates what department is handling the rush order. If it is an order from a customer within the ship & offshore segment, then the aftermarket department handles it, and if the order comes from the land & transportation segment then the sales department for land & transportation handles it. It is important to know some differences between the two main segments. Since the ship & offshore segment has a larger production variety compared to the land & transportation segment, the handling in the ship & offshore segment could sometimes be more challenging.

> *Product variation at Jets is very big, we got a product base of approximately 7000 different parts, and so the different possibilities of making a new product are huge. But of course this differs from what kind of segment one operates in – like the land & transportation segment, there are 5-6 different models with a standard set of parts. The product variation is much larger at the ship & offshore segment.*

The next step is to check stock if the spare parts are in stock or not in the ERP-system (Visma). Here it is very important to check if the parts are reserved for production or not because if it is reserved for production the part is technically not in stock to be shipped out as a spare part. If the parts are not in stock, it will cause a delay for the customer. Here Jets need to check with the customer if the delay is acceptable for them or if it will cause problems for them. If it is acceptable for the customer, the purchasing department at Jets purchases the part, and the process goes on as illustrated. If the delay is not acceptable for the customer, Jets and the customer would need to find a solution to that problem, if not the process will end.

The next step is to check with the shipping department to see if the shipment can be shipped to the customer within the requested time. If this is not manageable, Jets would also here need to check if it is acceptable with a delay with the customer or not. If a delay is not acceptable, one would also here need to find a solution or end the process.
If Jets have the part(s) in stock, and it is manageable to ship the part(s) within the requested time, the shipping department creates a shipment with a transportation company. From the transport company they receive the details about the shipment such as the shipping number so that the shipment can be traced and the shipping labels. Further, the warehouse department packs the shipment and adds all the labels and documentations

needed for the shipment, and then a transportation company picks up the shipment and ships it to the customer.

This process is the same when it comes to standard orders, but the difference is that the rush order is both packed and shipped the same day. But there have been made mistakes made in this process, and a mistake that sometimes happens are as described in chapter 1.1 that parts which are not available because they are reserved for production are taken and being shipped. This causes problems for Jets, which will be described in more details in chapter 5.4.

5.2.2 Handling rush orders regarding productions

When handling a rush order that has to be produced, the process is similar to the process for handling spare parts (see. 5.2.1). The main differences are that one now need to start a production to be able to finish the order. Jets do not have a finished sanitary system in stock because of storage capacity and because the orders are often different. Jets also need to produce some of their spare parts since not all of them are off the shelf parts. It is difficult to forecast the production a long time ahead, and Jets do not start a production before an order is confirmed by the customer.

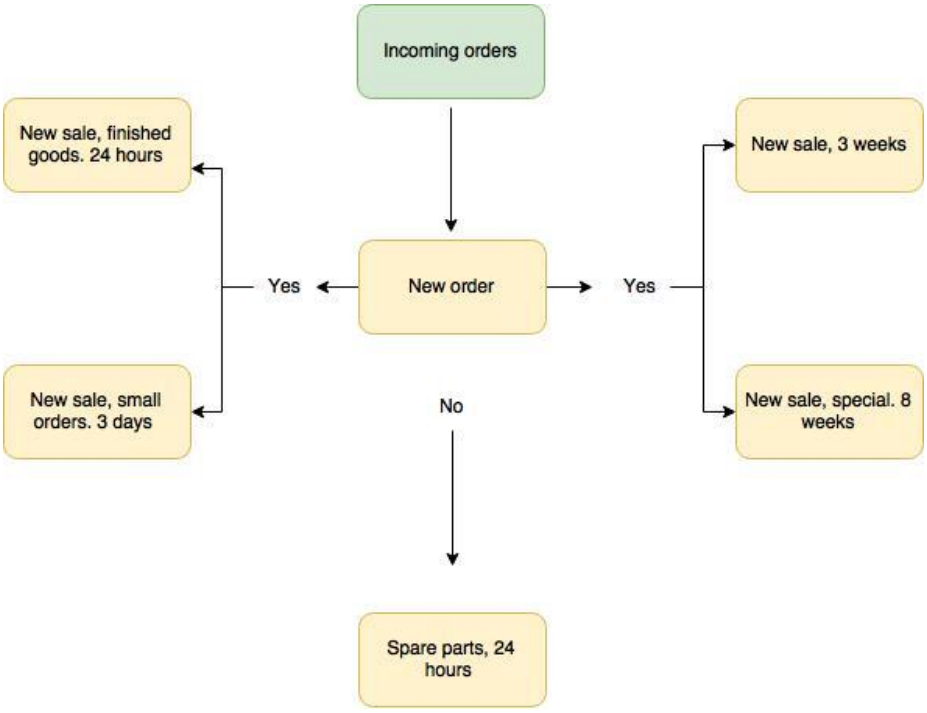

Figure 27: Standards for time used on different orders after the order is confirmed

Figure 27 above illustrates the different standards Jets uses for their orders. Again there are some differences between the two segments, and as mentioned before, the land &

transportation segment is more standardized than the ship & offshore segment, which also makes it easier to produce systems for the land & transportation segment. The ship & offshore segment is more customized because the sanitary systems have to be customized to fit the ship and therefore the production for the ship & offshore segment more time-consuming. When a customer places an order and makes an inquiry that he or she needs it faster than the standard from Figure 27, the order becomes a rush order.

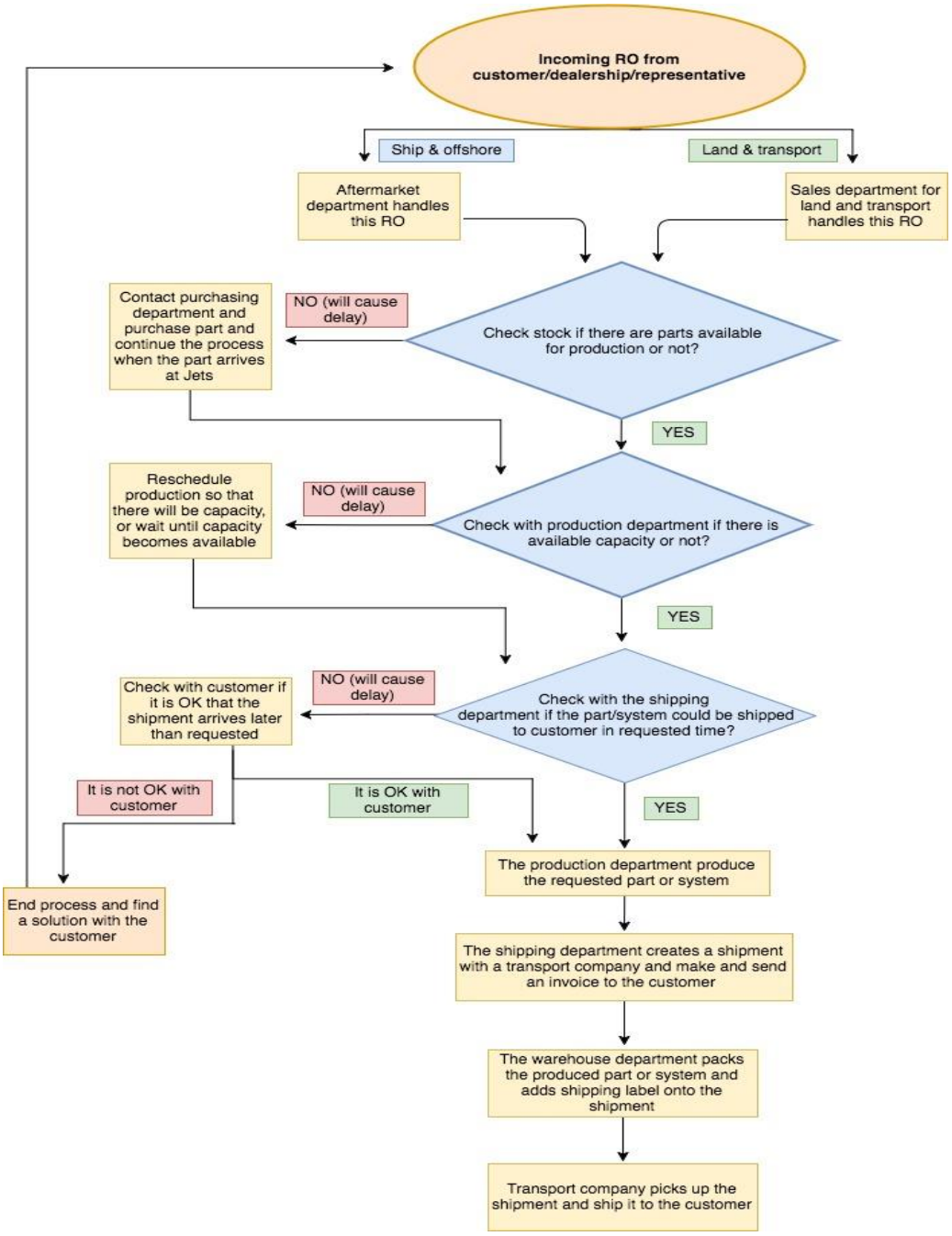

Figure 28: Overview of how a rush order regarding production is handled by Jets

Figure 28 above illustrates a simplified overview of how a rush order is handled. As mentioned before, the main difference from the spare part process is that one now needs to start a production to finish the order. Therefore, one needs to check the capacity in the production department and if there are parts available and the order can be shipped to the customer within required time, the production department produces the order.

5.3 Causes

In this chapter we will highlight the main causes for why rush orders arise at Jets. This to provide some knowledge on how the employees at Jets understands this problem, and what they believe are the main and indirect causes for rush order to occur.

5.3.1 Inquiry from customer regarding faster delivery

Jets have a set of standards for the time they can use regarding their productions and spare parts (see Figure 27), which many of their customers don't know, and are not supposed to know it either. So a lot of their customers believes that the sanitary system Jets produce is an off the shelf product, which is not the case. Sometimes Jets would need to produce the sanitary system from scratch, which takes a lot more time than what the customers believe.

> *One example could be that we receive an order that has a production time of 3 weeks, but the customer needs it in two weeks. If we make it we get the order, if we don't produce it within two weeks, we lose the deal. So we try to make it as far as the production line can make it. Probably we would get some implications since we maybe have stretched us too far to get the contract.*

5.3.2 Commutation problems

Many customers at Jets go through dealerships or representatives when they place an order. When the communication goes through more than two people, there could be some lack of information when it has to go through so many stages. Jets have experienced that dealerships and representatives are calling them and wondering where the sanitary system or spare parts are since the customer has not received it yet. This causes a rush order because Jets want to please their customers and will therefore try and get the order as fast as possible to the customer.

5.3.3 Customers, dealerships, and representatives not having spare parts in stock

Jets have experienced that rush orders are caused as a direct consequence of customers, dealerships, and representatives not having spare parts in stock. Some of the rush order could have been avoided if they had spare parts in stock. In both segments, Jets often see that customers, dealerships, and representatives don't have spare parts, which Jets have recommended them to have.

> *We have often recommended our customers to have a certain level of spare parts so they could respond quickly if their system had a break down due to a broken part. In particular, in Greece, we have had a lot of problems regarding customers not keeping stock of those spare parts that are crucial and the demand is high. Our customers have been recommended to have a minimum of critical parts in stock and on board the ships, to be able to avoid some of the upcoming rush orders.*

So if an unplanned repair occurs, it will become a very urgent situation. If the end-user don't have any spare parts and they contact their dealerships or the representatives who do not have any spare parts in stock them either, there will be placed a rush order at Jets. Then the end user can risk not getting the parts as soon as they hoped to and they can end up not having a functionally sanitary system until the spare parts arrive.

> *We could have a customer that have contacted one dealership, which should have critical parts in-house but don't have them. This causes them to contact us since the dealer doesn't have them in stock. This creates a rush order to us. And if this comes in on Friday afternoon, the customer won't have it before Monday.*

Jets is struggling with dealerships and representatives who do not want to have spare parts in stock, which causes them to place rush orders at Jets if a customer needs a spare part.

> *There is no way that we can tell our dealerships and representatives to have spare parts in stock – crucial ones. The reality is that if we ask them to have a stock, we would have to pay for it and control it since they are not willing to pay for keeping extra stock of spare parts. We've tried it before to control the stock at the*

dealership or representative but it just creates provocations, and it's something we do not want. So there is no clear setup for having our dealerships and representatives to have spare parts in stock.

5.3.4 Problem with shipment

Jets have experienced problems with shipments because something has happened during the shipment. Some examples of problems that could occur with the shipment are:

- The transportation company lose the shipment and can't find it
- The shipment ends up at another destination or in some extreme cases in another country
- The transportation companies split the shipments, and the customer receives the shipment in two parts.
- Damages on the shipment

And if the shipment is delayed, damaged or lost, it could cause the customer to place another order, and often are that order a rush order.

We had an incident where the transportation company split a shipment to a customer who had ordered a system for his cabin. In the shipment, there was a large sewage tank of 3000 liters and a pallet with toilets that were weighing around 150 kilos. The customer received the sewage tank, but not the pallet with the toilets on. When we asked where the missing pallet had gone, the transportation company was not sure. What was so special in this case was that the customer had ordered a plumber and a helicopter for a specific date so that he could fly up the system and install it in his cabin. Unfortunately, we were not able to send him a new pallet with toilets in time, and the transportation company had to cover the costs for the plumber and the helicopter.

So when something happens to the customer's shipment, it often causes a rush order since many customers depend on their shipments to arrive within time.

5.3.5 Cultural differences

Jets experience that some customers place more rush orders than others and the reason for this might be the cultural differences and expectations.

> *There are some cultural differences between our customers. Greek and French customers are the once who always need something urgent. Especially the Greek customers are always in an urgent situation, as long as it doesn't cost any extra. If something cost extra such as express delivery with a transportation company, it is suddenly not that urgent anymore for the Greek customers.*

5.3.6 Knowledge about the product

Jets experience that many customers do not have enough knowledge about the product regarding what they should order and whether it is urgent or not. This causes their customers to sometimes place an unnecessary rush order when it actually could have been ordered as a standard order. It also causes problems for the employees at Jets since it is difficult to help the customer if they can't describe what is wrong with their system or the part that they want to order. Another case is that the customer orders parts that they do not need, but they do not know it since they don't have enough knowledge.

5.3.7 Customers do not plan their purchases

Other aspects that might cause rush orders to appear, is the time it takes for an order to arrive to the customer. Not all customers are aware of the delivery time and if the order has to go far up north in Norway or other places in the world, the delivery time can be longer than what the customer expects.

> *In some cases, it is crucial for the customer to receive their spare parts or system within a certain date. For example, a ship leaving shore, which will be out for some months. If they don't get their spare parts before the sailing date, they might be forced to stay in port longer. This will cost a lot of money for them.*

If it takes seven days for the order to arrive at the customer, and the customer will leave in 8 days, it will be treated as a rush order. This is done to ensure that the customer will not face any delays or problems due to their sanitary systems. Another example of how rush

orders are caused is poor planning. Jets have experienced a problem of receiving many rush orders separately, instead of having one big rush order.

> *We had a ship that had up to 6-7 orders for a month, which shows that they did not plan as good as they should have.*

5.4 Effects

In this chapter, we will highlight what would be the effects caused by incoming rush orders at Jets. To bring out what the rush orders do with Jets and what repercussions it will entail if this is not handled properly in the future.

5.4.1 Rush orders affects the production

Rush orders are creating a lot of rearranging in the production at Jets since rush orders are often prioritized and often are pushed first in the queue. This creates difficulties when it comes to planning the production since the rush orders are often produced before standard orders, which is already scheduled. When planning orders that have to be produced, Jets would need plan the production capacity and make sure they have reserved the right parts for the production. The rush orders can disturb both the capacity planned and the reserved parts.

> *We could risk that an order that is placed two years ahead, suddenly we don't have the parts needed because the parts have been used for other purposes, such as rush orders. So when the time comes and we reserve parts six weeks before due date, there are sometimes nothing in stock. This is very difficult to explain to the customer why this order hasn't been finished due to what have been promised, especially when we have had two years to finish it. This is a clear weakness in our system.*

Since rush orders are often produced before standard orders, the backlog of standard orders can therefore increase. A direct consequence of increased backlog is longer delays on standard orders.

5.4.2 Extra costs due to rush orders

As discussed in 5.4.1, the backlog of standard orders could increase due to rush orders. In many of those cases, Jets may occasionally have to add more resources like manpower, to the production line. This to ensure they can handle their work in progress, which could cause extra costs for Jets concerning overtime payments to their employees.

> *In many cases, we have to add more resources to the production line so that we can reduce the number of hours' other orders have been delayed with. Our main focus will always be to deliver at promised due date, and we would extend extremely far to make it.*

Jets perceive handling a rush order as a service, which leads to increased costs. The high service level Jets provide their customer with often causes normal orders being handled as a rush order. The problem of having such high service level is that their customer base has increased over the years. From being an innovator with few customers to now have a lot more, the cost has become much more. And since Jets don't charge their customers for the service they provide with, it inflicts Jets with only cost and no income to cover it. This lowers their potential earnings.

> *It is the customer that controls how Jets operates their service, not Jets – customer driven service. But it is important to differentiate between which segment one operates in. In the land & transport segment, it is Jets that controls more how things are done since the product variety is very standardized to a set of models (5-6 models). In the ship & offshore segments, it is more the customers who control what have to be delivered through their representative. We now have extensive use of telephone support and service phone 24/7, as we do not charge money for answering technical questions, we are following up customers, and monitoring representatives. This starts to cost money eventually.*

5.4.3 Rush orders affects the inventory

The spare parts at Jets are usually the same parts being used in the production, which could lead to problems for Jets. The rush orders have to be handled quickly, which may result in non-compliance with the stated standards (see 5.2). The rule of thumb is to always check up with the ERP-system (Visma) if the parts are reserved for production or not.

Some of the main problems could be located in the warehouse/production department. This department has been known to not check up with the ERP-system for reservations, but to only check if there are parts physically in stock. If they find the needed part, they take it and send it due to the order date.

By having someone taking parts from the inventory and don't check up with the ERP-system if that specific item is reserved, nor register that they take it in the ERP-system. It causes the ERP-system to show an incorrect inventory level. This would have consequences for the production since it could cause delays because of lack of parts, and it could also cause delays for spare parts because the parts are not in stock.

5.4.4 Stressful work environment

The rush orders could lead to a stressful work environment since rush orders have to be handled in a very short time of period. With increased stress, the chances of human errors also increase, and an example of human errors that is being caused by stress is the example in 5.4.3 where employees do not check the ERP-system to see if parts are reserved for production or not.

5.5 Solutions

In this chapter, we will highlight how Jets have implemented solutions cope with the problem of rush orders, but also potential solutions that were highlighted from the interview with employees from Jets.

5.5.1 Service level using segmentation

Jets have divided their customers into segments, and the reason for having their customers divided into different segments are because the product delivered is different regarding how the product is designed, but also what the customer expects from it – specialized vs. standardized. The segmentation helps Jets to differentiate their customers much better so that the employees at Jets can more easily specialize themselves to handle inquiries and orders from the different segments. Concerning the problem of rush order, Jets rely on their experience on how they should prioritize incoming orders, not with the concern of which segment they get the order from, even though they know the differences due to the level of specialization and what it requires regarding segmentation.

In the past, we had a system where we classified our customer regarding good and bad once, since it was very clear in the past which one should get the kind of service they deserved. At this moment there is no clear distinction between our customers. The differences are based on perception and experience, which causes some customers to be prioritized first.

5.5.2 Standardize the product and produce finished goods

Jets have a large product variety with a product base of approximately 7000 different parts. With many different parts, it can increase the number of different rush orders that could occur. When the number of different parts increases, the number of different parts one will need to have in stock will also increase. A solution could be to standardize the product more.

One would always try to keep the same production base as far as it gets, even though it is pretty hard regarding the different segments that we operate in. At this moment our customers are satisfied with the production base we offer, but the trend goes towards more specialized products that it has been before. This creates more trouble for us regarding keeping stock of all the different articles that is needed.

Another challenge Jets face, is that the sanitary systems are different in many of the segments, but they want to create a more standardized product that could fit in both segments.

At this moment, we try to see if there in any way would be possible to operate in different segments at the same time, but by having a basic-set that would be used to make the sanitary system. Instead of having many sets of products, we want to standardize the basic set so it could fit regardless of segments. In general, we know this would be very difficult to achieve since the market is constantly evolving. Customers are more and more specific in what they want, and their standards are higher. If we could have a two-set component build up, it would be much easier for us to create standards and create a better level of service due to spare parts and other things. To have one standard solution for the toilet seat, and then combined it

with another set of standards. To have models ready before orders turns up, sort of finished goods at stock. This would create a much better environment regarding delivery time, but it would require a lot internally to make this solution feasible and profitable.

5.5.3 Spare parts

The problem where their customers, dealerships and representatives don't keep spare parts in stock, which is one of the main causes for why rush orders occur at Jets. A solution Jets have come up with to try and help customers to have spare parts is that Jets have in the ship & offshore segment made a set of spare parts that they offer to their customers. The set contains the most important spare parts, and the customer does not have to figure out what spare parts he or she need to purchase.

Not all dealerships and representatives have a stock of spare parts. Another solution regarding spare parts could be that Jets were stricter regarding the dealerships and representatives having spare parts.

If all of our dealers and representatives were told to keep a minimum of inventory, we believe it would have affected the rush orders drastically. If we could have set strict rules that all of our dealers and representatives should have kept a minimum of inventory, it would be much cheaper for both the dealers and representatives and the customers. One business package sent with express delivery costs approximately 400-500 NOK in shipping costs. For us at Jets, it would relieve the pressure regarding the handling of rush orders and we could focus more on standard orders.

5.5.4 Educating the end users about the sanitary system

As mentioned in 5.3.6, knowledge about the sanitary system could cause unwanted rush orders to occur in Jets system. Their dealerships and representatives go through mandatory training given by Jets so that they can handle sanitary system delivered by Jets better. The problem often lies with the customers or the end users who do not have the knowledge they should have about the sanitary system. The customers receive a user manual about the system, but it is often not used. A solution could be to offer the customer more training and education about the system. This could help the customer to plan what spare parts they

should have in stock, but also help to fix the sanitary system if there are any problems. With more knowledge, the customer knows which part they would need, and how long it could take for them to receive it.

5.5.5 Longer lead time on productions than what is needed

Jets have created some standards to sort out the different orders that show up in the system (Figure 27). In these standards, they have added slack so that they could better cope with unpredicted rush orders or other implications to prevent delays – it makes it possible to maneuver it with some extra time. If Jets don't have the necessary parts in stock, they would have time to order up needed parts for the completions of the product. This would enhance them to provide their customers with a better experience and reduce the possibility of delays, which might inflict them with costs due to delays.

5.5.6 Introducing rush order fee

Jets have considered looking at the possibility to change how they operate, by having a fee for handling incoming rush orders. Since they don't receive any payment for phone calls nor any payment regarding the handling of a rush order. At this moment they are very unsure if this would be possible to introduce since their customers usually gets their will, and handles it subsequently. Jets are afraid of that it would backfire them if they introduce such a fee to defend why they accept the rush order. Cost like indirect cost of handling a rush order is not given to the customers, but directly inflicts Jets with more costs, which lowers their total revenue.

5.6 Dealerships and representatives

In this chapter, the empirical findings from our interview with the dealerships and representatives is presented where the findings from the dealerships will be presented first in 5.6.1, and then the findings from the representatives will be presented in 5.6.2.

5.6.1 Dealerships

In this section, the empirical findings from our interviews with the dealerships will be presented. The findings that are presented will mainly be concentrating on how the rush orders occur at the dealerships or at their customers, information about spare parts, and some of the solutions that the dealerships suggest to prevent rush orders from occurring.

The possible solution of placing a rush order fee is also commented by the dealerships in this section.

All the dealerships feel that they have a good relationship with Jets. Concerning the service provided by Jets, they all feel that Jets are very helpful if it is something is urgent. They also share the same view on the communication and information sharing between them and Jets, where they all are satisfied.

5.6.1.1 Bryne Rør AS

Bryne Rør AS argues that it is important to differentiate between new production and warranty cases to understand the differences of the different rush orders, that not everyone is the same.

> *We often see that when a customer has decided to purchase a Jets system, they will have this in place as soon as possible, thereby creating a rush order or a request for quick delivery. Toilet facility is essential, and a customer cannot be many days without functioning toilet facilities. When the system does not work there will soon be a "critical situation" and this leads to a sense of urgency to the customer, through the dealer, who could trigger a rush order at Jets.*

Bryne Rør AS don't keep stock of spare parts if they are not critical for the functionality of the sanitary system. They argue that the knowledge of the sanitary system is essential and without the knowledge of it could be difficult for some dealerships and customers to understand what parts could be beneficial to have in stock.

> *We keep stock of those parts we believe to be the most critical based on our knowledge, but for those dealers who don't keep stock of those parts, it could indirectly cause a rush order. This may be connected with little awareness and lack of knowledge about the products. It might help the customers and dealers to understand the importance of the product by having service seminars and educate about the system characteristics and other important aspects of the system. This would likely increase awareness for the need of having spare parts.*

Further, Bryne Rør AS argues that demand plays an important role regarding knowing what spare parts they should have in stock as it can vary according to the different months throughout a year. Their stock of spare part is also influenced by the cost since one do not want to tie much capital to the stock.

Bryne Rør AS is very skeptical of introducing any additional fees for rush orders.

> *In situations where the sanitary system is not working, we sometimes have no other choice but to place a rush order. Customer must pay the price being set. From a cost standpoint, a fee charged for handling a rush order can be justified. But based on the responsibility that Jets have to their dealers and end-user, it cannot be recommended. It could be perceived as "greedy" and the opportunity to take advantage of others misery. If Jets will charge for the service, it is no doubt that it would damage our relationship with Jets and the end-users. Although the system is easily constructed, it requires special expertise to resolve certain issues. Then it will be vital that we as a dealer and end user can get help outside normal working hours, without this having to be paid for.*

5.6.1.2 Hallingdal Varme & Sanitær AS

Hallingdal highlights that break down in the sanitary system as one of the main drivers for rush orders to arise. If a system to a cabin customer breaks down, it is very important for that specific customer to retrieve a high-quality service, with fast response, in order use the system normally again. Other causes for rush orders to appear, Hallingdal argues that the lack of information, uncertainty, human error, lack flexibility, knowledge about the product – in general, bad logistical planning, to be other causes for why rush order appears.

> *An example of how to handle rush orders would be by having a service suitcase with the most crucial parts. By having a service suitcase, we could respond better and faster, and lower the risk of creating a rush order.*

However, most of the time they have spare parts in stock, but often they feel they can't protect them self against every single break down since it is very difficult to anticipate which part one would need to have in stock to be able to serve their customers with. But

they have thought of some solution that they think might help them and Jets, to reduce the possibility of creating a rush order.

> *Something that could help us do our job better would be if we had a list of parts and parts number. Once we have used one of the parts, we could easily reorder new parts.*

If a customer's system breaks down, Hallingdal places a rush order the moment they don't have what the customer need. When the system can't be used, the urgency is high, but they will always try not to place a rush order as far as it is possible. Hallingdal believes putting a fee for placing a rush order, would probably help Jets create a barrier against incoming rush orders that which is not rush orders. Hallingdal argues that it won't be them as a dealer who will need to pay for it; it would be their customers.

5.6.1.3 Tempe VVS AS

Tempe VVS AS highlights that a rush order is created depending on when the customer placed an ordered and what time the customer expects to receive the order. An example could that the customer contact Tempe VVS AS and don't understand the time it will take to make the sanitary system and send it - the customers don't know how the system is made or that some of the parts need to be made from scratch. There is clearly a problem that the customer needs to understand how this product is made so that they could prevent rush orders to appear. Tempe VVS AS highlight the need for better communication together with Jets, to inform their customer how long an order could take and what parts need to be produced, would help a lot. Tempe VVS AS also addresses that human errors could also cause rush orders.

> *Other problems concerning rush orders, is that we have forgotten to put the order we have received from a customer at a cabin booth event, into our system. So the customer calls us and asks where the system they ordered for three weeks ago is? Since we have promised the customer to deliver the system within a certain date, we would need to handle it as a rush order, which creates huge stress for Jets and us.*

In general, Tempe VVS AS don't have the problem of stock out, since they usually keep stock of the most important parts in-house at any time, to prevent cases like rush order. The problem allies with the customer do not understand the importance of having spare parts themselves, so they contact Tempe VVS AS when the sanitary system has broken down instead of having parts and try and fix it themselves if possible.

Regarding the problem of incoming rush order, Tempe VVS AS state that one could arguably use a fee to interfere and maybe reduce the incoming amount. It could also help to sort out which orders that are rush order, and those who are not.

> *If a rush order was going to cost some money, we do not think it has anything to say to the customer. The assistance outside of normal business hours (weekends) should cost something.*

To sum this up, Tempe VVS AS argues that the lack of information about the product, human errors or the logistical planning, could be the reason for why rush orders arise.

5.6.1.4 Hønefoss VVS AS

Hønefoss VVS AS points out that one should plan for incoming rush orders to cope with the challenges it brings with it. Hønefoss VVS AS keeps some spare parts in stock to handle incoming rush orders, but not much. The reason for this is the lack of capital on their hand and some due to poor stocking.

Further, Hønefoss VVS AS mention why they believe rush orders are placed and indicate that their logistics are not good enough to handle many customers, a hectic schedule and again, bad planning by them, as well as they have some human errors that cause rush orders. They also mention the problem of getting the right information from customers can create rush orders, but they argue that not all customers have all the information they need.

> *In a building process of a cabin, it happens that we might need to order some parts within a very short time.*

To reduce or stop incoming rush orders, Hønefoss VVS AS don't believe it would help any to charge their customers or them for placing a rush order to Jets.

5.6.2 Representatives

In this section, the empirical findings from our interviews with the representatives will be presented. The findings that are presented will mainly be presented in the same way as in the previous chapter with the dealerships.

Also, the representatives feel that they have a good relationship with Jets. They are also satisfied with the service from Jets, and they are also pleased with the communication with Jets.

5.6.2.1 Technique Marine Service

Technique Marine Service mentions that the way their customers perform their purchasing is one of the causes for why rush orders occur.

> *We have the problem where the customer has an urgent need for parts but does not wish to order them until the last minute, which creates a tremendous stress on our system to be able to handle it since they need the parts before the vessel sails. A potential saving for the customer if they place their orders earlier would be for rerouting the vessel and avoiding possible downtime.*

Other potential causes for a rush order to arise from Technique Marine Service customers could be the lack of knowledge about the problem. The customer doesn't pay attention to sanitary systems, and the attempts Technique Service have done to educate their customers about the sanitary system has proven fruitless.

> *It usually not the lack of info, but the lack of willingness by customers who do not plan and therefore does not place their orders earlier.*

Technique Marine Service tries in their best way to not misuse the good service they get from Jets, but if it is necessary, they place a rush order. And if they place a rush order, they trust that Jets will provide them with what they need in time, and the service due to customer support have been excellent so far.

Further, the case of having spare parts in stock could help a lot concerning the problem. Technique Marine Service mentions that some of their customers keep stock of spare parts on their vessel, but no one keeps it in their warehouses.

> *Our customers don't want to keep stock of spare parts, which is not urgently required since they don't wish to use money on it. We keep some spare parts, but most of them are now outdated.*

Technique Marine Service also argues that Jets have too many types of spare parts and that makes it difficult to keep track, which makes it more logistical challenging. They also mentioned that they do not have access to Jets' database of parts that are linked to each vessel. The parts they have in stock are mostly outdated.

Furthermore, Technique Marine Service argues that money is not an issue for their customers when things become urgent and that their customers only place a rush order when they need something urgently. Regarding having a rush order fee, Technique Marine Service argues that it would be difficult for their customers to accept such a fee if they don't get a guarantee that their parts will arrive in time. This is difficult to guarantee to the customer since there will always be a risk of delays.

5.6.2.2 MS/ Technology Ventures Middle East FZC

MS/ Technology Ventures argues that the reason for rush orders to show up is because the customers do not plan which spare part they need.

> *Rush orders could have been avoided if the customer will check and prepare for the required spare parts for one year in advance. If the vessels have provided their required spare parts for one year, there would be no room for rush orders.*

Regarding the issue of keeping stock of spare parts that are crucial to the sanitary system to work, MS/ Technology Adventure holds some spare parts in stock. If they don't have it in stock, they contact Jets and create a new purchase order for the parts they don't have. The reason for not keeping all the different spare parts in stock is because the demand patterns are too volatile and the risk for the parts to be outdated – afraid of binding too much capital.

Further, MS/ Technology Adventure believes that putting a fee on rush order would not affect how they operate their business.

> *We believe it is not an issue for the customer if Jets will place a fee for handling rush orders.*

The communication from the customer could be challenging for MS/ Technology Adventure sometimes. They mention that the customers usually provide the shipping details only when they receive the readiness/packing details of the order.

5.6.2.3 Technava S.A

Technava S. Technava S.A mentions that there are some differences regarding the size of their customers, where small ones don't have strict service procedures for their sanitary system. The effects of this would be that the sanitary system wears quicker over time, and causes the system to break down eventually and the customer then places a rush order.

> *We have recommended our customers to have spare parts onboard to avoid the problem and consequently avoid rush orders. Some companies have proceeded with that solution, but in general, there is no preventive mentality (at least in Greece).*

Technava S.A also highlights poor logistical planning to be a major cause for rush orders to occur, since many of their customers don't plan their orders in time. The small companies don't have the standard routines as the bigger ones have. Sometimes their customers don't have the enough money when they place an order at Jets. This results in that Jets don't send parts to Technava S.A customers before payment is received.

> *Recently we have had an experience with spare parts for the main engine. A company with six vessels was trying to find about 4000 USD for ordering the goods. By the time the money is collected, they now need the spare parts that should have been sent weeks ago, in a few days, which creates a rush order. It is Greek mentality to not have spare parts on board the ships.*

Other problems regarding rush orders, is the problem where the customers needs spare parts but is not urgent. Technava S.A have seen some problems where their customers have placed urgent in the subject in an email – like a bad habit that their customers do without they knowing the consequences for doing it.

Regarding the stocking policy of spare part, Technava S.A doesn't keep spares in stock. The only parts they have are for demonstration purposes when they have new customers who would like to see how the system works and looks like. So when new spare parts are needed, they always order them from Jets. Technava S.A argues that there are no point for them to keep stock since they are stationed in Greek, but the vessels they serve are all around the world. Therefore, it won't be any difference if they or Jets keep stock of spare parts. Their customers also accept the delivery times that Jets have, which Technava S.A argues is very short.

> *Our previous experience of keeping stock in Greece for other manufacturers (for pumps) was not very successful because our stock couldn't satisfy the complete order, for one order we had two dispatches (one from Greece and one from abroad).*

Further, if Jets have placed a fee for handling rush orders to take away the ones which aren't rush orders, Technava S.A is not very convinced that this would be the solution to reduce rush orders over time. Their customers are already complaining about the price of spare parts and the tight policy of Jets.

> *We believe that increased fees and prices would have a negatives effect on the selection of Jets in new building projects, but it might be that it would work for some customers.*

6.0 Analysis and Discussion

In this chapter, there will be conducted an analysis of the empirical findings (see 5.0) from the interviews done with Jets and their dealers and representatives, and we use the literature from chapter 2.0 as a framework for the analysis.

6.1 Rush order

The literature has very few definitions that give us a clear understanding of what a rush order is. One definition that underlines the most important aspects concerning rush orders are the following; *"…rush order is an order that did not arrange within time of the current schedule placed in a very short time of delivery, and need to be handled in a very short period of time"* (Trzyna, Kuyumcu & Lödding, 2012). It is also important to acknowledge how important rush orders are, that it should be given the highest priority since it has a very small window to be handled in due to time (Yao & Liu, 2009). These definitions given by Trzyna, Kuyumcu & Lödding (2012) and Yao and Liu (2009) makes sense in that way that it is almost impossible to plan rush orders, which makes the time threshold difficult to predict and how it affects normal operations. The interesting part regarding these definitions is whether Jets have a different opinion of what a rush order is, but also how the dealerships and representatives define a rush order. Based on our empirical findings, the concepts of rush orders haven't been used as a term within Jets, since they haven't classified it as a rush order, more like providing a service to the customers. Therefore, Jets do not have a clear definition of what a rush order is, and what is not. It is also difficult to know that since there are different degrees of how urgent an order is compared with another order. But as mentioned in 5.1, the orders that have to be packed and shipped the same day are the nearest definition Jets have for a rush order. These orders are also prioritized before standard orders and do not follow the standard time guidelines. We could therefore say that the definitions provided by Trzyna, Kuyumcu & Lödding (2012) and Yao and Liu (2009) fit the rush orders that are being placed at Jets.

If we move over to what causes rush orders to be placed, both Jets (see 5.3), the dealerships (see 5.6.1) and the representatives (see 5.6.2) have come up with various causes for why rush orders occur. Svensson and Barfod (2002) mentioned that when material was missing when something were to be produced, caused a rush order to be placed. This underlines what Hønefoss VVS AS mentioned (see 5.6.1.4), were in the

building process of a cabin there could happen that parts were needed within a very short time to not delay the construction process. This could also be the case when a ship is being built, but since we have not interviewed any of the shipyards that Jets supply with sanitary systems, we cannot confirm it. Yan-Hai et al. (2005) argues that having the right documentation at the right time is crucial for planning properly. If one does not plan properly, it can cause rush orders to occur also at Jets. The communication between Jets and their dealers and representatives has been described well from our empirical findings. But as mentioned in 5.3.2, there could sometimes be problems with communication, which could cause a rush order to arise. This has more with the communication between the customer and the dealerships and the representatives to do, then with the lack of documentation.

In the literature review, there emerged various effects that the rush orders could have on companies. Many of those effects were the same effects that we found from our empirical findings (see 5.4). Both Plossl (1973) and Chen (2010) argue that rush orders delay standard orders, which also occurs at Jets (see 5.4.1). Unplanned orders such as rush orders also caused lead times to vary, backlog to increase, and to create the work in progress to varying according to Kim and Duffy (2004). Ehteshami, Petrakian, & Shabe (1992) also mentioned that since the rush orders were prioritized, it could affect the scheduled plan and one would need to rearrange planned productions. These effects were also found at Jets (see 5.4.1), so we can say they are applicable for our findings. Ehteshami, Petrakian, & Shabe (1992) also mentioned that rush orders would decrease the service level on standard orders. This was not directly said from the interview with Jets, and Jets tried to have the same service level for all their customers. But since the rush orders could cause delays on standard orders as mentioned in 5.4.1, one could argue that the service level will decrease because of that. How rush orders affected the stock level (Ehteshami, Petrakian, & Shabe, 1992) will be further discussed in 6.2 because the rush orders had some effects on the spare part stock level according to our empirical findings. At last, Ehteshami, Petrakian, & Shabe (1992) argued that the rush orders would increase the cost of delays. He did not mention what costs would increase, but Jets could face financial penalties if they were delayed with an order. Jets could also end up covering for costs that their customers will receive if the order is delayed and not received within confirmed date. An example could be the example in 5.3.4 where the customer had ordered a plumber and a helicopter. In that

case, it was not Jets who caused the delay, but if Jets had caused the delay, they could risk covering the costs for the plumber and the helicopter.

To eliminate all rush orders from occurring, are not likely to happen for Jets. Some of the effects that the rush orders bring with them are also difficult to get rid of. But there are proposed some solutions to how to lower the number of rush orders from occurring and how to handle the rush order in a way that could ease the effects of the rush orders. From our empirical findings, there were presented some solutions that Jets already uses, but also some new solutions (see 5.5). The dealerships and representatives did also present some solutions (see 5.6.1 and 5.6.2). Davis (1993) and Wang and Chen (2008) argue that using inventory can be a solution to both preventing a rush order from occurring, but also to smooth out the variation due to supply and demand. Jets and some of the dealers and representatives have inventories with spare parts, but this we will look further at in 6.2. As for inventories with finished products/systems, it seems from our findings that it will be difficult for Jets have that due to the variation from each order and lack of standardization. They have managed to have some finished products in the land & transportation segment, but in the ship & offshore segment, the variation is too large.

Wang and Chen (2008) also argue that if one reserve capacity, it could help to cope with rush orders. This have Jets done, and Jets have also stated that if needed, the employees will work overtime sometimes. The risk of having both inventory and reserving capacity, is the risk of not using it and one will end up wasting money (Wang & Chen, 2008).

The size of the customer, the amount of the product that is ordered or the profit it would create, are criteria's that Wang and Chen (2008) argues one should have for handling rush orders. Jets do not arrange their customer such as Wang and Chen (2008) suggest because they try to treat all their customers the same and offering the same service level for everyone. It was mentioned in the interview with Jets that they had tried to divide their customers before, but it was not successful and Jets went back to handling all their customer the same.

As mentioned in 5.5.6, a possible solution that Jets had thought of, was to introduce a fee that the customer had to pay when they placed a rush order at Jets. The first thought about it was to cover some of the costs for having a high service level, which eventually had started to cost a substantially amount of money. But we also thought that introducing a fee could be helpful regarding eliminating some orders that were placed as a rush order that actually was not that urgent. In 5.3.5 there is mentioned that especially the Greek

customers are always in an urgent situation, as long as it doesn't cost any extra. If something cost extra such as express delivery with a transportation company, it is suddenly not that urgent anymore for the Greek customers. Therefore, we asked the dealerships and representatives about their opinions around a rush order fee, and if it could reduce the number of rush orders. The findings from the interview with the dealerships (5.6.1) and the representatives (5.6.2), did not give us a clear indication of whether the number of rush orders would decrease or not by introducing a rush order fee. The majority of the dealerships and representatives were negative to adding such a fee, and it could create various negative effects for Jets. But some dealers and representatives argued that a rush order fee could be added, and it would have been interesting to know how such a fee would affect the amount off incoming rush orders at Jets

6.2 Spare parts

One of the causes for why rush orders occur at Jets is directly linked with the problem with customers, dealerships, and representatives not having spare parts in stock (see 5.3.3). The consequence of having customers, dealerships, and representatives that don't have an inventory of the most crucial parts in-house, would create an immediate problem when the need for spare parts arise. Jets have recommended that their customers, dealers and representatives should keep stock of the most crucial parts, but as mentioned in 5.3.3, it is difficult to get them to keep inventory. Jets believe that the effect of dealerships and representatives keeping a minimum of inventory of spare parts would have a drastically effect on the rush orders (see 5.5.3). Unplanned repair caused by breakdowns of the sanitary system, which is one of the causes for why rush orders occur (see 5.6.1.1, 5.6.1.2 and 5.6.2.3), causes very unpredictable demand patterns (Martin et al., 2010) that are very difficult to forecast (Huiskonen, 2001). The required response is also very short because when a sanitary system does not work, one needs to be able to repair it as soon as possible. Safety stocks have to be applied to compensate for the demand variations that the unplanned repairs bring with them (Kennedy et al., 2002), and to be able to respond to the customer as soon as possible (Cohen and Agrawal, 2006).

One problem that seems to be common among Jets' customers, dealerships and representatives is that a large part of them do not keep a minimum of spare parts in stock so they could respond better to incoming rush orders. Managing spare parts inventories is difficult because one often do not know which part one should have in stock or if one need

any spare parts at all. This we can relate to from our empirical findings since one dealership (see 5.6.1.1) and one representative (see 5.6.1.2) highlighted that their customers and end users did not have the knowledge about the sanitary system to know what parts they should have in stock.

A problem highlighted by their representatives and dealers is poor planning done by their customers. Instead of requesting parts they don't have in stock within a very short time frame, they should try to analyze which parts they need in-house, with help from Jets. Huiskonen (2001) have proposed four control characteristics for spare parts and these characteristics were to be used to identify what spare parts one should have in stock and what parts one should not store. These characteristics give us some answers for why customers, dealerships, and representatives do and do not have a spare part inventory. The four characteristics are the following: criticality, specificity, demand pattern, and value of parts. Criticality is one of the main reasons for why customers, dealerships and representatives keep spare part inventory. Regarding our findings from the dealerships and representatives, we see that most of them keep an inventory of the most critical parts in terms of the functionality of the sanitary system. The specificity of the product does also have a link with the criticality since many of the spare parts for Jets sanitary systems is only produced or supplied by Jets. This reduces the supply of Jets products, and it would be helpful for their representatives and dealers to keep a certain level of spare parts to reduce the risk of rush order and unnecessary delays. The demand pattern does also play an important role because the dealers and representatives use the pattern to know what spare parts they should have in stock. The dealerships and representatives point out the last characteristics, the value of parts, as an important factor regarding having spare parts in stock or not, because they do not want to tie up too much capital in spare parts. The risk of parts become obsolete is also a risk such as Cohen and Agrawal (2006) argues, and that is being mentioned in our findings (see 5.6.2.1 and 5.6.2.2). That parts becoming obsolete could have a link with the product variety that Jets have (see 6.4), but also that Jets is an innovative firm that seeks to develop new models or improved models. This increase the risk of their old spare parts to be outdated and cannot be used on newer systems, only the old ones. The risk of losing their money by investing in spare part is high concerning the high product variety and increased demand for new systems.

That the customers, dealership and representatives have spare parts in stock is an important factor regarding avoiding rush orders from occurring. It is clear that not everyone wants to

have spare parts in stock and we have been able to address some reasons for why they do not want to store that many spare parts. But to reduce the number of incoming rush order, we believe it would help to place spare parts in inventories further down in the downstream of the supply chain.

6.3 Demand Uncertainty

Seemingly many of the incoming rush orders arise as a direct consequence that their dealers and representatives don't keep stock of the most important parts. If they have kept stock of the most crucial parts, it might help to reduce the demand uncertainty that Jets experience. In 2016 they had approximately 8% of Jets' orders were rush orders, which disturbs their normal production line and might cause delays (see. 5.1). By making their dealers and representatives to keep stock of important parts, might reduce the problem of uncertainty, but not everything, since it will be almost impossible to predict everything. The literature mentions how difficult it is to predict quantity, what type, timing and location. That the forecasts are wrong, the customer changes its behavior, like specifications and mix of the product they order (Angkiriwang, Pujawan & Santosa, 2014). Especially companies that produce innovative products would be very affected by very a volatile order horizon by their customers, which was the case for Jets for many years. Most of the time they operate with orders that could be characterized within the production environments engineer to order and make to order, which have a very high uncertainty level. But Jets do also have some products that are within the production environment make to stock, which has low uncertainty level. This would differ regarding which segment they operate in. The one with more uncertainty level is the ship & offshore segment, where most of the system is made to fit that specific installation. On the other hand, Jets have the land & transport segment where Jets have made 5-6 standards that they use, which lower the uncertainty level (Angkiriwang, Pujawan & Santosa, 2014). In order, to cope with demand uncertainty, Simangunsong, Hendry and Stevenson (2011) argues one could use postponement, information sharing, buffer stocks, and lead time management since the variation of demand is very difficult to predict (uncertain), but possible to reduce with the right actions. Davis (1993) argues that by having an extra inventory of the parts that is demanded the most could smooth out the demand variation. This could be one way of holding rush order under control (as discussed in 6.2). One does never know when unexpected repairs show up and would work as smoothing or safeguard to prevent a collapse of the system (Kennedy et al., 2002). Lead-time management could

help handling the level of uncertainty, by controlling their representatives and dealers, one should create a space between the actual time it takes and what their customer knows. This would help Jets to keep unpredicted order, such as rush order to be handled within time. Unplanned orders like rush orders would be a direct cause of how the lead time vary, the backlog increases and work in progress goes up and down (Kim & Duffie, 2004). With the strategy of lead-time management, Simangunsong, Hendry, & Stevenson 2011 argues the importance of keeping lead-time promises longer so that they have the flexibility to handle unpredicted events. Jets have already made this scheme where they have some buffer time concerning lead-time (see. 5.2.2). Nevertheless, it will reduce the speed to the market (Simangunsong, Hendry, & Stevenson, 2011), one could argue that it would not be suitable in a case of a rush order, where everything would need to happen fast.

Regarding reduction of lead-time in urgent situations, one should focus on production flexibility (Chapman, 2006), that the production process is very flexible due to shifting demand patterns. This should be highly valued regarding how one should act when incoming rush orders occur, which seems to fit for Jets situation. Jets seemingly have a problem when unexpected things happen, and they would need to act outside their standards. Jets have tried as far as possible to standardize their system, but it seems to have backfired when unpredicted orders show up in their system. Due to the literature, one might say they have handled it correctly due to time, but the system appears to not be as flexible as is should be, to be able to handle shifting demand patterns.

6.4 Product complexity and product variety

Jets have created an environment for a very high product variety, like 7000 different parts (5.2.1), which creates their product to be very complex and makes the problem even more difficult regarding sorting out the rush order problem concerning the relationship among each part (Closs et al. 2008, Blackenfelt 2001). An important aspect concerning the rush order problem is that one should keep the requirements in balance, which is the dilemma of having a product that requires a lot of different parts, it creates even higher product complexity (Closs et al., 2008). To cope with the complexity, one could use modularization to handle it better (Blackenfelt, 2001). Jets have tried this in the land & transport segment, where they produce 5-6 modules for their customer to choose from (5.2.2), even though they have experienced that it is very difficult to meet the market expectations with such approach (5.2.2). This has become more and more difficult, where

it has shifted more from only processing a complex product, but also to manage all the information linked to the product (Svensson and Barfod, 2002).

The higher the product variety is, the more it affects the operations at Jets. Wan, Evers and Dresner (2012) address problems like fill-rate, the sales quantity and the cost impact it has – that more product variety causes it to have a negative impact on the operations. But it will create higher sales in the short run, but in the long run it will decrees (Wan, Evers & Dresner, 2012). Others point out the importance of giving the consumer the ability to choose among various products, that this will attract new customers, and in the end cover up for the inefficiency cost (Pindyck & Rubinfield, 2005), like rush orders might be an indirect cause. This is in fact what have happened at Jets, where the customer has forced this by telling Jets what they want, which have led Jets to do as they have asked for. Of course, this is not only the customer who has led the product variety high, but Jets themselves has a significant role in this. They could have been much more apparent in relation to the customers to reduce the amount of product variety and which makes it easier to handle rush orders. One could handle the product variety if one could point out what exactly the consumer wants (Perloff, 2004), but it is very difficult to find the optimal set of product variety (Hill & Jones, 2014), which is also the case for Jets (5.2.2). The interesting part with answering to the customers' needs is that it would be almost impossible to achieve economic of scale and the lead-time would be longer (Hill & Jones, 2014). This is in conflict with what is discussed in the part about demand uncertainty (6.3) since it focuses on how they could achieve better environment of reducing lead-time, buffer zones like stock and time buffer. Nevertheless, one could say that the literature and Jets have the same opinion concerning the problem of knowing what the consumer wants – difficult to reduce the product variety and at the same time find the product that the consumer wants. With a high product variety, it could also affect a number of spare parts dealers and representatives have to have in stock to be able to cover all the different systems their customers have. This could lead to that the dealers and representatives do not want to cover all the different systems, and when an urgent need for a spare part occur and the customer or end user places a rush order, it will end up at Jets.

6.5 Customer Service

Jets have as mentioned in 5.1, perceived handling rush orders as a service they have provided to their customers. Regarding the service that Jets provide their customer with, they don't have a clear set of standards that explicitly tells what service level they are going to give their customers. It is their customer who sets the service level regarding customer requirements, but seemingly, by giving the customers always right, one could say that Jets set the service level at 100% (see 5.4.2). It seems they haven't been able to handle the transition of being an innovator in the sanitary system market, going from only having a few customers, to now have many. Providing with excellent service to few customers is manageable, but many without rearranging the system to handle it is very challenging. And it is very costly to have a high service level, and it should be weighted against the revenue (Gourding, 2006). Jets used to classify their customer regarding good and bad customers based on different criteria's, but it did not end successfully, and they went back to treating all the customers the same. Before it was easier to divide those who were bad and good but know Jets don't find this useful. It is now purely based upon the experience of their customer. (5.5.1). The importance of knowing which level of service one should provide the customer with depends on the how elastic they are. The quality level of service provided by Jets could gain or lose 10% of their revenue (Ellinger, Daugherty & Gustin, 1997) and by losing customers could cost the Jets up to eight times more than the costs of keeping one (Gourding, 2006). This might explain why Jets have given their customer always right, and if one look at the cost and revenue, good service might serve Jets. We don't have any numbers that can substantiate this statement, but one can see that they have been wondering how they should handle their service level towards their customers. But as mention in the literature, having two capabilities like logistical efficiency and flexibility is important to ensure good service (Tracey, 1998). Seemingly out of our empirical findings, their dealers and representatives seem to be very satisfied with the service provided by Jets; they get a quick response when they need help with something – flexible (5.6.1). So when a problem occurs with the sanitary system, which might create a rush order, they respond to their customers with high service. This might be one of the underlying reasons for why they have the problem of rush orders; they give in too much by exaggerating the service they deliver. Saying yes to orders, which could have been sent as a standard order, not as a rush order.

6.6 Information flow

How the information flow is within Jets and with their representatives and dealers, is important to discuss, to ensure that the information given is correct. An excellent logistical system should have a continuous information flow to handle any shift in the demand and handled correctly and in time for quick response (Lambert and Cooper, 2000).
Better information sharing is needed to ensure that one get the right information at the time (Simangunsong, Hendry, & Stevenson, 2011), ensuring that every party in the transaction has the same info at the same time. Nevertheless, it is very difficult to deal with if you lack the necessary information and documentation to make a proper plan (Yan-Hai et al., 2005). Problems like the time horizon cause some of Jets' dealers or representatives to send requisitions too late, and a rush order is immediate created (see 5.6.2.1). This causes an enormous stress on the production system at Jets. Sharing the information of how long a production order takes could have stopped the rush order from being made. If their customers have known how long it would take to produce a new product, we believe their customer would have set the order in time. Problems of not sharing the right information at the right time seem to be a problem for both Jets and their representatives and dealers, which makes them unable to reach a responsive supply chain. To enable a proper information flow, they would need to handle it properly (Singh 1996), as well as having a good strategy where planning, operations, and information are crucial (Chopra & Meindl, 2010). Jets have organized their sales through representatives and dealers, which creates another layer between the customer and Jets that could create lag in the system and even a higher risk of not getting the right information or that something has been let out (see. 5.3.2). This have led to rush orders, and even caused Jets to operate with informal communications channels to solve it – using best practice to handle the problem. We believe the literature is spot on concerning problems of information flow, and mention how important it would be to get the right information at the right time, to ensure a responsive supply chain, which Jets needs, to be better equipped to reduce rush orders for occurring. This would be elaborated further in 6.7.

6.7 Efficient vs. responsive supply chain strategy

According to what have been discussed in the previous sections (6.6), it is important that Jets finds a suitable strategy towards their representatives and dealers – a strategy that meets their customer best and should then chose whether they want to be responsive or efficient (Chopra and Meindl, 2010). By now they arguably have some features of a responsive supply chain (see Figure 8), which we also believe is the best strategy to have towards the event of rush orders from our understanding. Quick response to demand, capacity flexibility, buffers, etc. (Fisher 1997 and Simangunsong, Hendry, & Stevenson, 2011) and modularization (Blackenfelt, 2001, Fisher, 1997) are some attributes one should have as a strategy to be able to handle a shifting environment. These attributes are the same attributes that are needed to create a responsive supply chain across the various subject areas. Regarding the problem of rush order, Jets have tried in their best way to be as responsive as possible, creating some modules for the land & transport segment (see 5.2.1), but it has been difficult to implement due to customer requirements (5.2.2). This also affects how they can respond to their customers when they can't create a modular build up regardless of what segment they operate in, which of course affects how quickly they can respond to incoming rush orders. They have even made a scheme to create room for flexible capacity in terms of creating room for more time due to different production (see 5.2.2 and Figure 23). Jets and the literature have many of the same features, but one could arguably say that if Jets have been able to have these features that are required for a responsive supply chain, we believe Jets would have stood much stronger by now to handle incoming rush order.

6.8 Cause, effect and solution model

To summarize what we have discussed and analyzed in section 6.0, we have revised the model (Figure 9) we made in the literature review (see. 2.6). The new model (Figure 29) is now based on the discussion and analysis that has been done which are based on our empirical findings (see 5.0) and the literature review (see 2.0). The model will be used to answer our research questions in the conclusion (see 7.0) that will give an answer to the overall problem statement (see. 1.4).

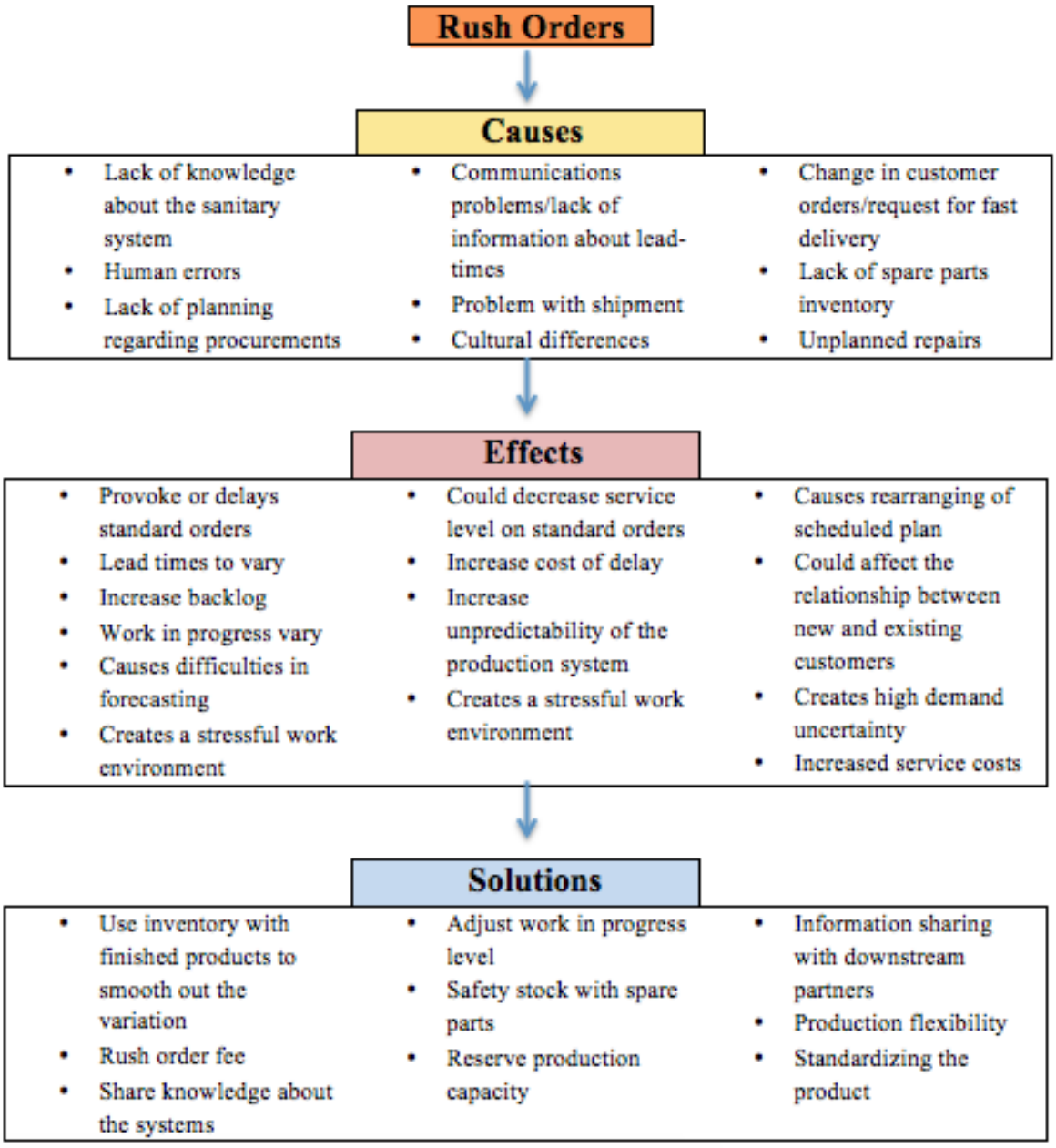

Figure 29: Cause, effect, and solutions model (Pettersen & Saunes, 2017)

7.0 Conclusion

In this research we have studied and analyzed rush orders at Jets. By doing so we have been able to explain what causes rush orders to be placed at Jets, what effects do they have on Jets as a supplier, and we have proposed some solutions to reduce the amount of rush orders and to ease the effects they have on Jets.

To our comprehension of the rush order field, the literature lacks information regarding rush orders and logistics within the sanitary system industry. So this thesis provides some new literature about rush orders, but also about logistics within the sanitary system industry. The definitions of rush orders from the literature, we have found to be suitable for the rush orders at Jets. We also used other literature then just literature about rush orders, which gave us more depth in our explanations about the causes, effects, and solutions.

In terms of answering our first research question, we have through our findings found various causes for why rush orders occur at Jets. Unplanned repairs are one of the main causes for why rush orders occur at Jets. These unplanned repairs need to be fixed within a short amount of time, and they can be fixed fast if the customers/end user, dealerships, and representatives have spare parts. But as our findings show, the lack spare parts further downstream causes rush orders of spare parts to occur at Jets. Why customers/end user, dealerships, and representatives do not have spare parts in stock can be linked to cultural differences, lack of knowledge about the sanitary system, and bad planning, but also other issues. To get spare parts to the customer within the requested time is also a cause for rush orders at Jets. Since they operate in a global market with customers all over the world and especially in the ship & offshore segment, the need for parts are crucial to arrive within time, and this causes some orders to be handled as rush orders. The communication is also crucial, and poor communication and the lack of information, can cause rush orders. Communication is relevant for rush orders regarding both spare parts and productions. Human errors, problem with shipments, and changes in customer orders or requests for faster delivery, are also causes we want to point out. Cultural differences, human errors, problems with shipment, and changes in customers demand are causes that are difficult to prevent. But the lack of spare parts, lack of knowledge about the system, bad planning, and communication problems are causes that we believe can be prevented or improved.

Unplanned repairs are difficult to prevent, but good maintenance of the sanitary systems can reduce the amount of unplanned repairs.

Our findings show us that rush orders have many different effects on Jets, and those effects will give us an answer to our second research question. Rush orders mainly affect the departments that are involved with rush orders. Since rush orders are difficult to predict and causes a lot of uncertainty, it affects the production at Jets greatly. The uncertainty and the fact that rush orders need to be handled quickly, creates a stressful work environment at Jets, which can lead the employees doing human errors. The rush orders are often prioritized before standard orders, this we have found can increase the backlog of standard orders, but also decrease the service level on them. To set the service level is also difficult, and we have found that rush orders could be a reason for why Jets have high service level. When the customer need something urgent, they usually gets it so that Jets maintain a good relationship with the customer. The result of the high service level Jets tries to maintain is increased service costs.

For the purpose of answering the third and last research question, we have also proposed some solutions that may decrease the amount of rush orders Jets receives and some solutions that may ease the effects rush orders have on Jets. Increased spare parts stocks further downstream, increased knowledge about the sanitary system, rush order fee, and increased information sharing with downstream partners are some solutions we have proposed that can reduce the amount of rush orders. Solutions such as using inventory of finished products to smooth out variation, reserve capacity, standardizing the product, production flexibility, and adjusting work in progress level are solutions we have proposed as solutions that can ease the effects rush orders have on Jets.

8.0 Limitations

Because this research is conducted within Jets, the research is limited to the sanitary system industry. Therefore will not all the findings be transparent to other industries. Since Jets is a Norwegian company, different views, norms and practices could also differ from what companies in other courtiers have.

We have interviewed dealerships and Jets representatives because a large amount of Jets' end customers goes through dealerships, representatives and Jets representatives when they place an order. We could also have interviewed end customers and more dealerships and representatives to gain a better understating. But because of the time limit we have, it would have been difficult to perform more interviews.

The dealerships, and representatives have been interviewed by email because of the geographical challenges, which could therefore limit the amount of information given and we will miss the body language from the interviewee. The communication with the Norwegian dealerships, representatives and Jets representatives has been conducted in Norwegian and in English with the international ones. The interviews with employees at Jets have been conducted in Norwegian because this is the native langue of the authors and to the employees that have been interviewed, and it would therefore be easier to express themselves by talking Norwegian than English. This could increase the risk of linguistics problems because the majority of the empirical findings have been translated from Norwegian to English.

Since rush orders is a field with very little information and literature written about it, we have limited us to literature we have found from searching for "rush orders" and literature we think is relevant. There could be relevant literature that may not have found, published or using another terminology that we have not reflected upon. We can also not confirm if the amount of rush orders that Jets receives is a considerable amount or not. We have not found statistics about rush orders, and therefore we cannot conclude anything.

9.0 Future research

What we discovered during our interviews with Jets was that they handled their rush orders as a service towards their customers. In this perspective, it would be very interesting to know what the actual costs for Jets are to handle rush orders. The time it takes is not considered as a cost for them, but as a service. We believe it would help them and others to know what the indirect cost of handling it would be and by creating awareness of the total cost picture might change how they operate.

It would also be interesting to use Lean as a method to identify possible waste in the handling of rush orders and if there could be any improvements.

Further, we have suggested some solutions that can improve the situation when it comes to rush orders, but we haven't been able to test these solutions. Testing these proposed solutions would have been very interesting for further research, to see the usability.

Since we have used the sanitary system industry for our thesis, we cannot say that our causes, effects, and solutions are transferable to other industries. We believe it could set some interesting standards for the literature of rush orders, if one could find some similarities across of different industries.

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11.0 Appendix

11.1 Interview guideline for Jets

Interview with Jets

A) General information about rush orders at Jets

- Describe how Jets handles rush orders - both the physical flow and the information flow, and the departments involved.
- What problems do rush orders cause for Jets? To what degree? Can you give some examples?
- How does Jets define rush orders?
- Why do rush orders happen?
- How does Jets decide that this incoming order should be a rush order?
- Do Jets see/interpret handling rush orders as providing a service to their customers?
- Is every rush order accepted?
- Does Jets have a specific strategy for rush orders? Have they made some routines for how to handle it?

B) Frequency and Costs of rush orders

- How many rush order do occur during a year?
- How many rush order are there within each segment? (Ship & Offshore and Land & Transportation)
- Do the rush orders cause any extra costs for Jets? If yes, what type of extra costs?

C) Products that is rush ordered by the customers

- What type of products is most commonly within a rush order? What is the reason for this?
- Are sanitary systems complex products? Any large differences in the products to the different segments?
- Are these products usually spare parts or do some need to be produced/assembled or purchased from suppliers?
- What is the size of these products?

- What is the cost of these products?
- Could documentation on the product cause any problems for handling a rush order? (Missing documentations causing delays for example)

D) Customers and agents

- Are there customers/agents that place more rush orders than other? If yes, what are the reasons?
- What differences are there between the customers in the different segments?
- Could the relationship between Jets and the customers/agents have an impact in the handling of the rush orders?
- How are the power balance between Jets and the customer/agent?

E) Suppliers

- Are suppliers able of providing parts quickly so that the lead-time of a rush order does not increase significantly if parts are not in stock?

F) Consequences of rush orders

- How do rush orders (negatively) impact your company? (e.g. higher costs, disturbing the production, causing delays of other products/standard orders, creating a stressful situation at the workplace that can cause further errors by the employees)
- How does the rush orders impact the production time?
- How does lean production cope with rush orders? Is it suitable for it?

11.2 Interview guideline for representative and dealers

Questions to Master's degree about rush orders at Jets Vacuum

Thank you so much for answering these questions, your answers will be of great help for us. It will be up to yourselves how much you want to answer on each question. If you have some questions, feel free to contact us.

What can be done to avoid placing rush orders?

- Could you give some examples of how rush orders occur and could some of them be avoided? Why/why not? What would be the potential savings?

- Does your company or customers have any spare parts from Jets in stock, or are the spare parts always purchased?
- Why do some representatives/customers not have spare parts in stock? Could it be something with: the criticality, specificity of parts, demand patterns, value of parts or the risk of parts becoming outdated?
- If Jets had for example placed a fee for handling rush orders, could that make you or your customers more aware of not placing many rush orders and rather try and find ways to not place rush orders? Or is money no issue when things become urgent.

Potential causes for placing Rush Orders at Jets

Under are some suggestions of potential causes for placing rush orders at Jets. Please select the most suitable suggestions and please explain why that suggestion cause rush orders.

Suggestions:

- Poor logistics planning?
- Lack of information?
- Uncertainty?
- Human error?
- Flexibility?
- Knowledge about the product?
- Stocking policy?
- Something else?

Purchasing and Relations with Jets as a supplier

- Are orders sometimes placed as a rush order, when it actually not particularly urgent? If yes, what is the reason?
- Would you say that your relationship with Jets is so good that you know you will get the help you need quickly when something is urgent?
- Many suppliers today charge for the service of phone support, but not Jets. Would you think the customers would accept this or could it damage their relationship with Jets?

Information flow and communication

- Could the lack of information with Jets or with customers be one of the reasons why rush orders occur?
- Do you get all the information you need when you place a rush order or do you often need to place several rush orders because of lack of information?