

Antti Vuorinen

Order Delivery Management

Case: Xerox Oy

Helsinki Metropolia University of Applied Sciences

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<p>This thesis discusses the importance of inventory management, specifically focusing on order delivery management. The thesis is written for a case company, Xerox Oy, the Finnish subsidiary of printing industry corporation Xerox Corporation.</p> <p>The thesis discusses how to optimize order sizes and the size of the customer inventory from the service provider's point of view. While it is at times important for the customer to maintain high inventory levels in order to maintain steady production, the service provider at often times wants to decrease their financial liability in terms of customer stock. In the case of Xerox Oy this is especially true, as the customer inventory is not billed per the agreement and is thus considered capital cost for the service provider.</p> <p>The main focus of the literary review is on how inventory management relates to Michael Porter's value chain and how theory can be utilised in the Xerox Oy case. The case is analysed by creating metrics to compare customer delivery data in the month of September 2012. The metrics are then compared to figures provided by Xerox Oy and their logistics service provider DSV Solutions Oy. Finally, an adapted balanced scorecard approach is used to reference the presented data.</p> <p>The conclusion of the analysis is that Xerox's current customer inventory philosophy causes their total cost of ownership to be extremely high due to a high number of individual transportation transactions. Customer orders are not grouped efficiently due to a lack of resources in order optimization, and therefore the processing of orders is not optimal, particularly for the largest individual Xerox customers.</p>	
Keywords	inventory management, customer service, order delivery, supply chain management, optimization

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1 Introduction

The importance of cost-effective process and flow management in modern supply chain management cannot be understated. The profitability and competitiveness of companies in all industries are being judged by how well they succeed in providing their customers with their products. In traditional industries such as the automotive industry, there is by default a very limited way in how to purchase and deliver a product, i.e. a vehicle, because of the physical nature of said product. However, the world around us has changed and, more importantly, customers have changed. Because of the wide variety of service options available for the modern customer, it is easy to, for the lack of a better phrase, cherry-pick the exact solution that fits the business model of the customer – be it logistics, marketing, consulting or equity management. This applies to both corporate and private customers, as the tailor-made solutions industry has become a highly profitable way of conducting business. Peter Drucker, famed management guru, argued that a company only has one purpose: that of producing customers (Drucker, 1999 in Grant, 2012: 16).

With that said, this thesis will focus on portraying the delivery of goods by a service provider to their customers in a traditional industry. As with most companies, the challenge of the case company is to provide products at a sustainable price while also following up with a competitive service organization. The referred case company is Xerox Oy, the Finnish subsidiary of Xerox Corporation, a multinational corporation in the printing industry, for whom the writer worked for during 2011-2012. Coming from a logistics undergraduate background, working for a company with set processes in service and logistics was a challenge and an opportunity to analyse the business model.

The single largest challenge that Xerox Corporation as an entity faces is similar to that of the bulk of the industry: a decrease in demand. While advertising and media spending rose by an average of 5 per cent in 2012, focus in print media continues to decline for the second year in a row (European Publishers Council, 2013). As laptop computers, smartphones and tablet devices among others are becoming increasingly common, the demand for printed news and books is decreasing.

It will remain interesting to see how and when the printing industry in general will improve its services to accommodate mobile devices into the service models of the respective companies in the industry. In order to stay profitable, Xerox Oy must therefore improve its internal processes, be it through cost cutting or innovation.

1.1 Objectives and scope

The main objective of this thesis is to illustrate the importance of inventory management by demonstrating with the help of a case company how the different operations of a supply chain affect one another. The secondary objective is to improve business operations at Xerox Oy, introduced further in Chapter 1.3. The thesis has been written upon their request as a business process analysis.

The goals of this thesis are as follows:

- Presenting the present supply chain of the case company based on qualitative interviews, empirical observations and statistical analysis
- Improving business solutions and presenting methods to improve the supply chain of the case company
- Provide and develop implementable processes for Xerox Oy

This thesis consists of two main parts, the first being a literature review and theoretical study and the second being a presentation and analysis of the Xerox Oy order delivery supply chain of printing supplies. The specific scope of this thesis is to improve the supply chain activities of delivering Xerox printing supplies to Xerox Oy customers. For the purpose of clarity it is important to note that while the company also has other logistics activities relating to Xerox printing machinery and the organization of field maintenance spares processes, they will be excluded from this thesis in order to reduce the scope.

1.2 Study methodology and limitations

The study for this thesis was conducted in three parts. First, an investigation of theoretical framework was conducted to create a foundation for suggesting solutions for the business needs of the case company. The theoretical study information consists of secondary data from different publications.

The second part of the study was to conduct qualitative interviews with case company employees to define the needs of the working environment. The sample size for these interviews consists of two employees working directly with consumer supplies logistics as coordinators and of one person in a managerial position of service activities in the company. Empirical research was also conducted through making observations in the day-to-day operation of the company, therefore collecting material for the purpose of the empirical study. The information was compiled during 2011, while the writer was working within the Xerox Oy organization as a back office coordinator and later financial trainee for a total duration of eight months.

Thirdly, a statistical analysis was created to support the qualitative interviews in finding the optimized solution for the company. The sample size of the analysis was the consumer supplies cost figures for the month of September 2012 as well as the related logistics cost figures for the month of September 2012. These figures were then cross-referenced to illustrate the pre-existing supply chain processes of the company. As a result of the qualitative and statistical analyses causes and solutions for the business case are then presented.

The limitations of this thesis are comprised of the sample sizes of the analyses. Due to the lack of relevant interviewees in the case company, all employees directly related to the subject matter on an in-country basis were interviewed in person. Furthermore, the sample size of the statistical analysis was chosen to be the month of September 2012, as it represents recent figures that suffice for the ends of the study. However, it only represents one period of twelve in one specific financial year, and therefore may be considered insufficient in size, as there is no opportunity to discuss trends in volume or profitability. This may be attributed to the stagnant nature of the printing industry, where a certain amount of advertisements, magazines and related products will be produced indifferent to the macroeconomic environment.

Furthermore, the specificity of this thesis is directed sharply towards a single facet of the entire Xerox supply chain regarding service. As mentioned earlier in Chapter 1.1, activities relating to the logistic organization of machinery and maintenance processes have been left out of this study for clarity. For future research it might be possible to delve deeper into the supply chain at hand in order to combine elements of equipment, maintenance and spares logistics to create a holistic analysis of the Xerox service approach.

1.3 Company introduction - Xerox

Xerox Corporation is a multinational corporation operating in 160 countries and employing approximately 140 000 employees. The company was founded in 1906 in Connecticut as the Haloid Company and was eventually renamed as Xerox Corporation in 1961. Xerox Corporation is focused in printing, information technology and document outsourcing with a selected array of services ranging from production printing machinery to small and medium sized businesses for less required printing capacity. The company had a \$22.6 billion turnover in 2011. (Xerox Corporation, 2013).

Xerox released its first commercial xerographic device, the Xerox 914, in 1959 and entered the New York Stock Exchange on July 11th 1961 as Xerox Corporation (XRX). Xerox also launched a joint venture into Japan as Fuji Xerox in 1962. In addition to printing, the company also was highly innovative in information technology and hardware, commercially launching Alto, the world's first personal computer in 1973, complete with a graphical user interface and mouse. This keen eye for developments in technology led to registering the seventh all-time .com- domain internet-address in 1986, Xerox.com. Xerox also invented the prototype of tablet computers in 1988, the PARCTab, a palm-sized wireless document reader (Xerox Corporation, 2013).

With the widespread of the internet and wireless communication in the 1990's, the printing industry has suffered a decrease in turnover during the last 10 years. Xerox still operates as the worldwide leader in printing and document management and continuously increases its service offering. In 2010 Xerox purchased Affiliated Computer Services, Inc., to strengthen its business process outsourcing services (Xerox Corporation 2013).

Xerox Oy is the Finnish subsidiary of Xerox Corporation, employing roughly 80 people. The company operates in Finland with a group of 12 concessionaires dividing the country regionally in sales and equipment maintenance. In addition to acting through concessionaires, Xerox Oy has direct deals with its largest customer accounts, mostly production printing customers in Southern Finland.

As many other multinational corporations before it, the Xerox Corporation has taken to divide its operation into larger entities based on geographical position and market size. Xerox Oy in Finland is part of Xerox Central and Northern Europe (CNE), which in part is a subsidiary of Xerox Europe (XE). In addition to Finland, the CNE area consists of Sweden, Norway, Denmark, The Netherlands, Belgium, Luxembourg and Switzerland, with Denmark and the Netherlands being the largest markets for Xerox in terms of revenue.

Xerox's most common service contract is called the Full Service and Maintenance Agreement (FSMA). The contract often charges a monthly or quarterly fixed cost, which in charge covers for the rent of the equipment and all equipment maintenance when required. In addition, the contract covers for Xerox's consumable products, i.e. printing supplies, which are printer toners, colour drums, xerographic units and other maintenance parts. Depending on the size of the equipment the customer may replace the parts when prompted without the assistance of a Xerox service engineer. The contract also charges a fixed sum, often ranging from 0,0005 € to 0,07 €, per printed impression on the machine, taking into consideration copies, prints and scans in colour or in black-and-white. This collection of impressions is called the meter reading of a machine.

2 Principles of inventory management in the supply chain

2.1 The supply chain and the value chain

The supply chain could be generally described as a collective of well-coordinated organizational functions that strive to achieve a common goal more efficiently than the competition (Christopher 2005: 5). The function of the supply chain is to support the organization in achieving its business goals. For instance, in most businesses logistics costs represent a considerable part of the company's total costs and therefore opportunities to increase operational margins through optimizing and decreasing total logistics costs are created (Christopher 2005: 11). This is also the case with Xerox Oy, whose logistics costs will be presented further in Chapter 4.2.

The supply chain and its related functions cannot be presented without discussing the value chain, which lends its functions to creating a margin of efficiency in the supply chain. The value chain, originally presented by Michael Porter, describes the activities of a company that are directly related to designing, producing, selling, distributing and supporting its products (Magretta 2012: 76-78). The primary activities of the supply chain are inbound and outbound logistics, operations, marketing and sales as well as post-sales service. As previously described, these functions are most responsible and also most visible to the customer in how a company creates value. These activities are supported by secondary support activities, which are infrastructure and organizational structure, human resources, research and development (R&D) and procurement or purchasing. These functions combine to create a margin value, as depicted in Figure 1, which contributes to operational excellence and therefore achieving competitive advantage.

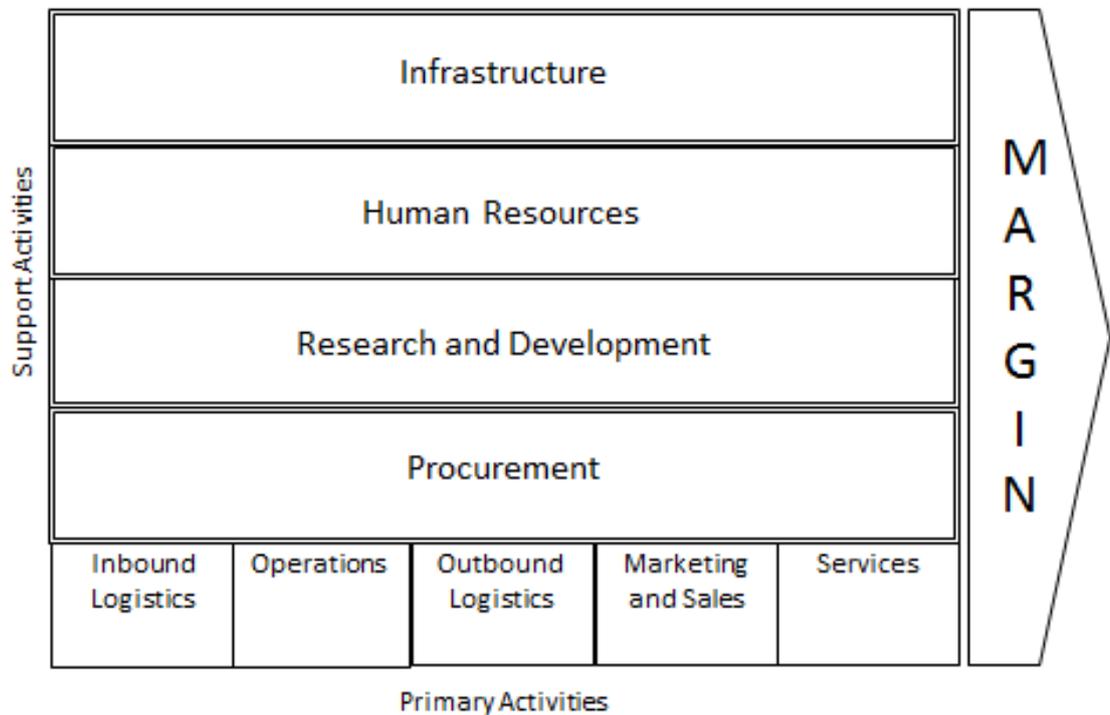


Figure 1. Michael Porter's Value Chain (adapted from Porter in Magretta 2012: 76-78)

Consequentially, the supply chain focuses on the linkages between the value chain functions and enhances the functionality of the upstream and downstream value adding activities (Christopher 2005: 17). These linkages are also called flows (Skjøtt-Larsen et al 2007: 20). A supply chain manager takes the activities of the value chain and finds the optimal suppliers for each activity based on the enterprise's strategy needs. For instance, well-executed operations reduce the amount of inventory required as a result of improved information and flow coordination (Johnston & Clark, 2008: 152).

Supply chain management is sometimes seen as a synonym to modern logistics. However, it is important to make a distinction between the two; while logistics deals with key functions such as transportation, warehousing, sourcing et cetera, supply chain management (SCM) deals with logistics management issues and adds the function of coordinating and collaborating with external and internal service providers (Grant 2012: 3).

2.2 Inventory management

One of the modern keys to operational efficiency in logistics is proper inventory management. The role of inventory is important not only for customers and suppliers, but also for departments throughout the enterprise. For instance, marketing wants high levels of inventory so that they can communicate it to the customer, while manufacturing requires a continuous volume of raw materials in order to keep running. On a contradicting perspective, the finance department wants to keep inventory levels as low as it is sustainable, since inventories are effectively considered as a fixed asset on the balance sheets (Coyle et al, 2003: 188).

As companies strive to savings primarily by reducing on fixed assets, inventory may be considered one of the foremost targets of cost cutting. Since logistics has only recently been thought of as its own business entity, several companies still have not responded with holistic financial plans to evaluate larger concepts effectively. Savings in this field has led to a boom of outsourcing warehousing activities, which in turn has created a need for optimizing logistics from a service provider point of view, competing on underlying aspects such as third party service provider strategy, resources for global uniformity in service as well as information technology capabilities (Lynch 2002: 635).

Inventory may be considered as having a dual role in general operations management. On one hand, work-in-progress (WIP) inventory is required in order to keep processes upheld, while simultaneously inventory is required due to the different imperfections of the supply chain. For instance, when forecasting demand it is necessary to always keep a buffer inventory at hand in order to compensate for the potential inaccuracy of the forecast (Johnston & Clark, 2008:152). In Xerox's case this means that a certain amount of WIP inventory must be available for the supplies deliveries may keep running at all times and that the size of said inventory has to be significant enough to account for unforeseeable orders.

Companies have different needs in regards to their inventory strategy based on the nature of the industry, supply chain and financial stability of the respective company. Companies that carry consumer products must carefully consider their inventory levels, as they cannot afford a situation where the demand of a product is higher than inventory supply, whereas the motivation for manufacturing-related service providers to keep

high inventory levels is to ensure the continuous flow of production (Coyle et al, 2003: 192-193). Xerox Oy could be considered as a consumer product company, as it faces similar difficulties in regards to its service based business model. The service perspective requires a high amount of goods continuously available in case of customer order peaks. Simultaneously it is imperative to keep costs low by reducing value tied up to inventory costs. This duality of inventory costs creates a situation where companies need to conduct a trade-off analysis, where various metrics and factors dictate the relationship between desired customer service levels and desired inventory investment, resulting in an optimization which gives guidance to the inventory management policies of the company (Coyle et al, 2003: 194).

However, it is important to notice the occasional inaccuracies of these estimations, as it is difficult to effectively value customer service levels, as the actions towards maintaining the desired level of service may result in highly different outcomes. Different companies and/or customers may consider themselves content with certain levels of service based on size and relationship with the service provider. Furthermore, it is important to take stock-out costs into consideration – i.e. the cost of not having products available in inventory at a certain point in time. Stock-outs create direct costs in form of loss of sales when the customer decides to purchase from a competitor instead of waiting for the completion of a back order (Coyle et al, 2003: 204). Depending on the relationship of the parties, stock-out costs may vary from a minor loss of trust to even losing the customer over continued delivery woes. From a planning and preventive standpoint, the loss caused by stock-out costs is difficult to determine as it fluctuates based on the size of the customer.

2.3 Carrying cost of inventory

Carrying cost of inventory is a financial concept used in weighing the different parts of inventory and warehousing costs in order to improve certain aspects. The carrying cost of inventory of four basic structures: capital cost, holding cost, inventory service cost and inventory risk cost (Coyle et al, 2003: 198-199). Capital cost is the largest and most focused one of the four, as it consists of investment capital tied up to inventory that could be used in other parts of the business, such as acquisitions, infrastructure or marketing. In this sense, capital cost of inventory could be considered as opportunity

cost to the business, which in turn makes the determining of the optimal amount of capital tied up to inventory crucial. Some companies use an internally specified hurdle rate, which is defined as the minimum rate of return expected in a new investment (Coyle et al, 2003: 198). There is no industry standard hurdle rate, so companies need to carefully adjust their approach to inventory value with the intent of reducing it to sustainable levels.

In addition to capital cost, inventories are maintained by so called holding costs, which are variable costs consisting of practical factors such as labour, handling, warehouse rent, heating and lighting.

Additionally, the goods in inventory need to be insured and/or taxed; this is covered by inventory service costs and may vary based on the nature of the goods in stock. Finally, inventory risk cost takes into consideration depreciation – i.e. technological advances or seasonal fluctuations – as well as damages to goods, thievery or other loss of products (Coyle et al, 2003: 199). The average holding cost of American companies in 2006 was roughly 30 per cent of their total inventory value (Russell & Taylor III 2006:529). As a technologically based company, Xerox Oy is interested in the effects of technological change and the change of its product base when it comes to inventory level specification, as excess amounts of technologically expired goods are not desired capital costs.

2.4 Inventory replenishment

There are two basic ways to replenish inventories: either through a fixed order quantity or a fixed time period system (Russell & Taylor III 2006:533-534). The fixed order quantity controlling type continuously monitors inventory levels on a per item basis, and is mostly supported by supply chain management software. The fixed order quantity often operates with the help of a set reorder point (ROP), which Xerox uses to uphold its inventory replenishment strategy.

The reorder point (ROP) is defined as an inventory level which directly affects the generation of new orders. Whenever the stock keeping amount of an item registers at less than the predefined reorder point, an automatically generated order is placed to ensure

that availability of goods at a desired level (Russell & Taylor III 2006:533). The reason for maintaining fixed replenishment is to optimize and alleviate the difference between carrying cost and order size, resulting in a more efficient supply chain strategy (Russell & Taylor III 2006:538).

When the reorder point is reached, a standard order is generated based on the economic order quantity. The time between the placing of the order and its arrival is called lead time, a general expression dictating the amount of time which is spent waiting for the supply chain to run its course. During lead time it is essential that inventory levels should not reach zero; rather, the focus is to have inventory levels as low as possible before the replenishment order arrives (Russell & Taylor III 2006:537). This duality of inventory levels peaks and valleys, creating a mean for inventory levels. This is then applied for the purpose of financial metrics to define the capital cost of inventory.

The reorder point is calculated by dividing the demand rate of a product per period and multiplying the division by the expected lead time in the supply chain (Russell & Taylor III 2006:547). For instance, if a company expects to sell 10 000 units of a product per month, with the expected lead time the reorder point of that product being 12 days, the reorder point would be:

$$\text{ROP} = \frac{10\,000 \text{ units}}{30 \text{ days}} \times 12 \text{ days} = 4\,000 \text{ units}$$

Figure 2: ROP calculation example

This means that when stock levels decrease to fewer than 4 000 stock keeping units, an order would be generated. A stock keeping unit or SKU may most simply be defined as one unique production unit with uniform features, design and function (Grant 2012: 80).

The fixed time interval based order management option is based on periodically achieving target inventory levels. An often used approach is to incorporate fixed order quantity methods to define the number of orders required per year, and then take into consideration factors such as lead time, reorder periods and buffer stock (Shridhara

2009: 158). The focus is on preserving a certain level of inventory at all times, which lends itself well for industries with high service levels and material availability requirements. The weakness of the fixed time delivery option in Xerox's case is that it delivers products on a periodical basis despite the levels of inventory at that specific time. Due to Xerox's focus on suppressing inventory levels to a minimum, the philosophy of constant replenishment despite demand does not match with the case inventory management concept.

2.5 Customer service

From an order delivery point of view, customer service may be considered inherently linked with outbound logistics, as it directly portrays the average customer perception of level of service, which has been established earlier as the timeliness and speed of the delivery. However, it could be further argued that customer service dictates the needs for the entire supply chain, serving as the focal point for modern logistics (Coyle et al, 2003: 92-93). In marketing terms, supply chain activities produce the outcome of delivering the correct product, at the promised time and amount, to the customer as well as retaining the expected quality without causing damages or additional delivery related costs. It could be argued that the essence of logistics related service value is to provide a higher perceived value to the product than its perceived cost (Grant 2012: 17). Structurally, service needs to meet the nature of demand in order for it to be on the required level and successful (Leenders et al 2006: 455).

To this end, the function of logistics is to ensure the marketing department's promised delivery dates and service levels are met. Failure to do so leads directly to lost sales and weakened margins throughout several departments, as customer service is not only supported by marketing and logistics. For instance, agreeing to certain billing terms, financing a project or investing, installing as well as maintaining equipment are also privy to the discussion of customer service (Coyle et al, 2003: 96). Therefore, if transportation of the goods fails to deliver the expected level of service, the effort put forth by the other departments towards customer service is erased in the eyes of the customer.

It is also worth noticing that service levels are monitored from both sides of the service provision contract, and if certain contractually guaranteed metrics are not reached, sanctions or even the loss of customers may be an end result of less-than optimal service performance (Leenders et al, 2006: 141).

Demand has a progressively growing effect on the entirety of the supply chain. It could be considered that the key to efficient supply chain management is accurately meeting forecasting demand. According to Russell and Taylor III (2006:532) the ability to meet demand is the key to establishing a desired level of service. Regardless of customer expectations, service levels and inventory costs increase in parallel manner; this is a direct result of the increase of capital investment in stock.

In order to illustrate the levels of importance of service in an organization, it is important to take into consideration the service as a level of product and then apply a level of involvement from an organizational standpoint. According to Coyle et al (2006: 95-96) there are essentially three levels of product that contribute towards customer service as an enhancement of the product. Firstly, customer service can be seen as an arbitrary task which needs to be completed due to expectation thereof. This level of service provision cannot be considered proactive or especially desirable, but it frees up resources to other parts of the organization.

Secondly, customer service can be seen as a performance indicator, measuring specific facets of service by determining a monetary value to the providing of the service, e.g. how many orders were delivered on time or how frequently goods were faulty upon arrival to the customer. This level of service takes an analytical approach to the benefit service activities. However, it is due noting that service indicators are not necessarily measurable at a distinguishable level (Coyle et al 2006: 96).

The third and most service-oriented level of organizational involvement is customer service as a philosophy, where the focus is on differentiating with service and therefore adding value to the product through service activities such as quality management, delivery time and reliability (Coyle et al 2006: 96). The added value to the product also makes the philosophy viable as a business alternative for the supplier.

In order to illustrate the level of commitment an organization has towards its customer service activities it is imperative to establish the most relevant metrics for service. Equally to the levels of service dedication, metrics for logistics customer service may be divided into three classes: pre-sales, order service and post-sales (Grant 2012: 18).

Pre-sales metrics may measure e.g. the availability of products – both physically in stock or the consistency of the supply chain process in order to improve flows – and order cycle times, measuring the different phases of the order process to improve upon lead time issues. Availability may be measured by e.g. categorical amount of SKU's in stock, amount of total inventory SKU's and monetary value thereof. Furthermore, order cycle times are more straightforward to analyse, as each phase of the order cycle is tracked for duration and assigned a percentage of time for the total delivery. These percentages are then compared and restructured for efficiency (Grant 2012: 20).

Service metrics during the order delivery process include accurate delivery, quality of delivery and product, amount of deliveries and other relative metrics in conjunction to these ends (Grant 2012: 20). These rudimentary metrics may be further analysed and cross-compared to match and improve business needs, as discussed further in Chapter 4 of this thesis. Furthermore, post-sales metrics may include technical support and availability thereof as well as customisable services. The purpose of providing services beyond the initial customer transaction is to retain the customer and to create lasting relationships.

3 Order delivery management at Xerox Oy

3.1 Order delivery process

The Xerox supplies order delivery process, as illustrated in Appendix 1, is in itself relatively efficient. When the respective supplies product, e.g. cyan-coloured toner, in the equipment is starting to run low, the machine starts to inform the user when the colour cartridge is at 15% capacity – that being the factory default setting that has been set to all Xerox printers in order to decrease machine downtime due to a lack of supplies. In most cases, the display of the printer prompts the user to order a new consumable unit but not to replace it in the equipment yet.

When prompted by the Xerox machine the customer is expected to telephone the Xerox Europe Welcome Centre, which is based either in Greenock, Scotland, Dublin, Ireland or Lutz, Poland based on the type of contract the customer has. In each case, all of Xerox's Finnish customers receive service in their native language by Finnish service agents who work in call centres operated by Affiliated Computer Services Inc. (ACS) and IBM in the aforementioned locations. These call centres are centralized in order to decrease labour costs.

When calling the Welcome Centre, the customer is first asked to enter the ten-digit serial number of their equipment in order for the SAP-based enterprise resource planning system, Voyager, to recognize it. SAP is arguable one of the most used enterprise resource planning software packages in the world, and it is configured to fit Xerox's business needs throughout the company.

Upon entering the serial number, either by entering the digits on the keyboard of the phone or through a voice recognition system provided by Xerox, the service agent answers the phone call and discusses the consumables needs of the customer. In most cases, the customer is only in need of a single package of toner and/or a colour drum. When receiving the order, the service agent asks the customer for the latest meter readings of the equipment and enters them into the system. This is done to validate the size of the customer's order, as there are parameters in the SAP-system which calculate the optimal order size based on the meter readings.

When a supplies order is placed by the Welcome Centre service agent, the SAP-based system immediately sends an order ticket to the central Xerox warehouse in Finland. The warehouse is located in Vantaa and is operated by DSV Solutions Oy. When the order is registered into the system, the DSV logistics workers manually pick the orders and then place them onto delivery vehicles. The company uses three regional distribution centres (RDC) as delivery hubs – one each in Tampere, Turku and Oulu – which are utilised to decrease the amount of individual transport transactions to more remote locations around Finland. Xerox promises its customers to deliver supplies within three working days, leaving little to no room for lead time related incidents.

All Xerox consumables are shipped to Finland from the Xerox central logistics hub which is located in Venray in The Netherlands. The Vantaa-based Finnish warehouse stores all supplies of Xerox office machines. It bases its operations on a local buffer inventory, which is replenished using a predetermined ROP for each product. The replenishment cycle is twice per week, on Mondays and Thursdays. The goods arrive to Finland from The Netherlands by road transport. Trucks are used as they are cost-effective and have a reliable schedule; one week from generating the order the goods will arrive in Finland. However, if supplies in Finland are depleted and an order is urgent, the Finnish Xerox in-country consumables team called the customer solutions organization (Finland CSO) may manually create an emergency order which will ship immediately and arrive two days later to Finland by airplane. Naturally, this is more expensive for Xerox but the procedure is used on occasion to satisfy the needs of crucial customers.

3.2 Order escalation

If the size of the supplies order is significantly larger than the system suggests it to be, the service agent is instructed to negotiate the order with the customer. The FSMA agreement allows the customer to order 30 days' worth of supplies in one service transaction, and this rule is enforced rigidly as it is the Xerox Europe standard. If the customer is still not satisfied with the size of the order after the initial negotiation, the service agent then enters it into the system as the customer ordered. The system then recognizes the transaction and escalates it to the Finnish CSO. The team consists of one person in Finland, who in addition to their other duties is responsible for clearing up the backlog of these exceptionally large supply orders.

The backlog is cleared by making decisions based on the order size, historical data and/or contacting the customer again via email or telephone. This is called the order escalation process. The in-country escalation process often lengthens the order delivery process by a couple of days, as roughly 30-40 orders are manually released through the escalation process daily.

There are no exact guidelines as to how much each order can be reduced from the Finnish side and making the decisions on a case by case basis requires an exceptional amount of time. In addition to this, escalation reduction percentages are monitored from the consumables team leader on a Xerox Europe level. As Xerox supplies have a quite variable price range, both the percentage of reduced items and the value thereof are closely monitored. Although the escalation process might not be considered optimal in terms of customer service level, it has been moderately successful in upholding Xerox's customer inventory management strategy.

3.3 Exception list

In terms of size and printing volume, Xerox's largest customers often exceed the parameters of the ordering system when creating their weekly supplies orders. For those customers, e.g. professional printing houses whose volume exceeds tens of thousands of pages per week, there is an exception list which is manually operated and updated by the Xerox Finland CSO staff. In order to achieve exception list status, the customer must specifically request it via email, and the procedure must also be approved by the Finnish CSO director. Managerial involvement is necessary for the process to continue according to company protocol.

The exception list also applies when taking into consideration customers with more than one piece of equipment in their location. The Xerox service agent in the Welcome Centre has a tool called the multi-machine order (MMO), which takes into consideration the amount of similar machines in accordance to their location and need of supplies. However, the function of the ordering tool has by management been deemed too slow to be used, as the registry of MMO's is very large. This means that the customer phone call would take up to five times as long when ordering for multiple machines, and most of the time would be spent on waiting for the tool to load customer data. The resolution in the past has been simply not to use the MMO-tool and rather enter a larger order

into the system, which then according to protocol has to be checked by Finland CSO. This causes a time-consuming ripple effect which heavily employs the in-country staff.

3.4 Results of the qualitative research

The qualitative research for this thesis was carried out to supplement day-to-day operations by observing the employees and conducting empirical research. However, noting the subjective nature of the study and the limited sample size, a statistical study was added to support the results of the qualitative research.

The qualitative research answered some questions regarding the lack of uniformity in order management. As Xerox has opted to use an exception list as its primary form of accepting MMO orders, the company has inadvertently created an unsystematic approach to order management. As referred to in previous chapter, the exception list is updated through a string of emails and subjective decisions by the customer service agent and management. Often at times these decisions are researched by broaching order history for the previous couple of periods, usually months or 45-day periods. However, the exception list itself is not systematically updated or followed-up to exclude customers that have for a reason or another decreased their performance over a longer period of time, since there are no extra personnel resources to specifically monitor performance on a regular basis. This need has been communicated to local management, but has not been followed through by the XE management.

Remote locations are a part of the problem in regards to keeping deliveries cost efficient. As per Xerox's current service focus, even the smallest deliveries are made directly to the customer site regardless of location. As Xerox has customer throughout Finland, this becomes a concern particularly in Eastern and Northern Finland, where distances between customers and logistics hubs are relatively long. As some of the company's largest individual clients are located in remote locations, they have been included on the exception list, giving them the permission to order exceptionally large quantities at once. However, this procedure is uncommon and requires more manual effort to complete.

4 Supply chain cost analysis

The statistical analysis for this thesis was conducted by acquiring supplies delivery data from Xerox and deducing the optimal manner to proceed based on the given information. In order to accurately describe the efficiency of deliveries, several different metrics and calculations were considered before arriving to the correct conclusion. The data consists of delivery-specific data from the reference documents in Xerox's SAP-system. The key information for the purposes of analysis is amount of goods delivered, amount of deliveries, total value of deliveries as well as number of individual customers. The monetary values of the deliveries have been changed to retain anonymity, but the relevant ratios and order sizes remain unaltered.

The total costs of supplies as well as the delivery costs are decent indicators, but they may often not accurately describe the efficiency and viability of the business model. Instead, in this situation it might be more beneficial to view the difference the amount of deliveries made and the number of supplies delivered. Due to Xerox's high focus in service and individual deliveries, the average order consists of e.g. one cartridge of toner per delivery address per week.

The formula to find the most efficient customers for deliveries consists of two parts. To first indicate the relationship between deliveries made and products delivered, the following calculation should be made:

$$\text{Delivery efficiency ratio} = \frac{\text{products delivered}}{\text{number of deliveries}}$$

Figure 3: Delivery efficiency ratio calculation

In order to be optimally efficient, the outcome of the initial calculation should be as large a number as possible. After forming this basic equation, it is beneficial to further tweak the efficiency ratio to highlight success in optimizing delivery sizes. Therefore, it was necessary to create a relative percentage index for products delivered by dividing the delivery efficiency ratio by the total number of deliveries. The created relative delivery efficiency ratio indicates how many per cent of total deliveries were delivered per individual delivery.

$$\text{Relative delivery efficiency ratio} = \frac{\text{delivery efficiency ratio}}{\text{number of deliveries}}$$

Figure 4: Relative delivery efficiency ratio calculation

The relative delivery efficiency ratio negates the tendency of the standard delivery efficiency ratio to skew towards delivery size. The prior ratio may undeservingly indicate delivery success for certain customers simply due to high volumes, leaving room for error. However, when observed with the assistance of a further developed formula the actual efficiency of the deliveries may be discovered independent of volume.

4.1 Xerox customer type introduction

In order to describe Xerox's customer base and its service needs, it is best to divide customer into certain categories based on their business needs and other relevant factors. For the purpose of illustration three basic types of Xerox customers will be discussed. Most of Xerox's customers that received supplies during the study period fall under one of these three categories:

Customer A: Corporate Office Customer

Customer B: Governmental Agency

Customer C: Printing Industry Customer

Customer A, an average corporate office customer, is located in one of the main centres of inhabitation in Finland – Helsinki metropolitan region, Tampere, Turku or Oulu –, thus having a suitable location for deliveries as Xerox's logistics partners have regional distribution centres on a short radius from the customer site. This suits Xerox's service philosophy well, as replenishment orders may be delivered on a consistent basis due to the proximity of the distribution centre. Most corporate customers have several Xerox equipment units in their facilities, often of the same model so that similar supplies may be used for all of the machines.

The average governmental customer is more difficult to define than the average corporate customer. Most of Xerox's governmental customers are public service providers such as schools, different agencies, libraries or hospitals. The locations of these customers are fairly evenly spread throughout Finland, so the delivery needs of these customers are quite varied. As mentioned earlier, some customers may be located in very remote locations in e.g. Northern Lapland or in Eastern Finland, leading to longer individual deliveries irrespective of the value of the delivery.

Customer B is a considerably large hospital located in a middle-sized city in Finland. The customer's demand for supplies could be characterized as stable, as the nature of the printing needs is very routine-like. However, this does not reflect in the ordering cycles as one would expect.

The average printing industry customer is located in a middle-to-large sized city in Finland in relative proximity to a Xerox regional distribution centre. Volumes tend to be larger than average and the demand is sometimes erratic. Urgent, large supply orders may sometimes come up on a short notice, putting a strain on Xerox's delivery chain to serve these customers. Simultaneously, printing industry customers also bring in the largest percentage of revenue to Xerox of the three presented customer categories.

Printing industry customers are often the most educated about Xerox's internal ordering processes, and are therefore able to demand a higher level of service. Therefore, several printing houses make orders which are larger than the escalation quota presented in Chapter 3.2, causing more manual work for the Finnish in-country Xerox team. This promotes relationships between the two parties as service is more personal, but also creates a slower ordering process.

Customer C is a middle-sized printing industry customer in a large Finnish city. The customer has a relatively small amount of individual machines, but print volumes per machine are extremely high. Therefore, a steady stream of supplies must be available at all times. To insure this, Customer C has negotiated an agreement to be featured in Xerox's exception list, as presented in Chapter 3.3. This enables the customer to create larger individual orders to ensure production isn't compromised due to ordering processes and the unavailability of supplies.

4.2 Order delivery cost analysis

In reference to Table 2 and the figures provided by Xerox Oy as detailed in Chapter 1.1, the sample size of the statistical analysis was 1 813 customers making 5 494 orders, thus delivering a total of 6 476 supplies. The average customer's monthly demand was 3,57 units, which were delivered in an average 3,03 deliveries. Therefore, the average delivery efficiency ratio was 1,18 and the average relative delivery efficiency ratio 33,00%.

The average delivery efficiency ratio is very high, because roughly 60 per cent (1 141) of Xerox's customers ordered only one or two supply units within the study period, as visible in Figure 5. This is caused by the nature of the average Xerox customer, as most customers have low-to-medium printing needs and do not have an outlying need to constantly order new printer supplies.



Figure 5: Xerox supplies delivered per delivery

Table 1: Xerox Oy customer example delivery efficiency ratios, September 2012

Customer	Total Value	# of Deliveries	Products Delivered	Delivery Efficiency Ratio	Relative Delivery Ratio	Value per relative delivery
Customer A	518,34 €	10	15	1,50	10,00 %	51,83 €
Customer B	598,83 €	34	41	1,21	2,94 %	17,61 €
Customer C	738,71 €	8	34	4,25	12,50 %	92,34 €
Xerox Average	66,57 €	3,03	3,57	1,18	33,00 %	21,97 €
Xerox Total (1813)	120 684,46 €	5494	6476			

Within the study period, Customer A has ordered 15 supply units for the total value of 518,34€. Due to the order automated order cycles, the 15 units were delivered in 10 deliveries. Using the formulas in the beginning of Chapter 4, the delivery efficiency ratio of Customer A is 1,5 and the relative delivery efficiency ratio is 10.00%.

As a result of Xerox's service focus and simultaneous minimization of customer inventory, Customer A has a very low relative delivery efficiency ratio. As discussed earlier, this focus on customer inventory further causes an inordinate amount of individual deliveries, which are invoiced per delivery.

Customer B has diligently followed Xerox's service policy by placing an order each time a Xerox machine requests one. Although the customer has operations in several buildings at their service area, 34 deliveries in 22 monthly working days is a high amount. The relevant ratios also indicate this, recording values significantly beneath Xerox customer averages.

Taking into consideration the nature of the demand, Customer B's inefficiency issues might be solved by restructuring their order delivery schedule. Instead of delivering twice a day, it might be possible to combine deliveries to reduce the amount of traffic into the service location. However, due to the limitations of the Xerox order management software, it is currently not possible to automatically combine orders. Xerox's logistics partner DSV might be able to reduce the amount of deliveries by combining or-

ders. However, as they invoice for each individual delivery, it is less profitable for them to do so under the current terms of the agreement between Xerox and DSV.

Customer C has found a balance between a feasible operative inventory for Xerox and the business needs of the printing customer. As a result of the exception list status, Customer C has a higher than average order size and efficiency ratio. While the delivery efficiency ratio is very high, it is due to be noted that this result requires additional effort from the Xerox staff to ensure efficiency, making these delivery levels unobtainable for most of the customers.

However, the three mentioned customer profiles are quite varied and are chosen not to depict the majority of Xerox customers, whose order size deviation is represented in Figure 5. As shown in Table 1, the average Xerox customer accumulates a much lower amount of orders and deliveries per month, while maintaining high delivery ratios. This result further reinforces the hypothesis that while the Xerox service and SAP-based order management system as replicated in Appendix 1 is effective, it lacks the ability to account for large customer accounts such as customers A, B and C.

While order related costs and statistics are the key to optimizing order sizes, it is also important to mention the logistics related costs created by DSV Solutions Oy. Carrying cost of inventory, as discussed in Chapter 2.3, is a valuable metric to distinguish the warehouse activity efficiency of Xerox. The data for the warehouse cost analysis was extracted from DSV's invoicing to Xerox during the month of September 2012. The invoices were analysed, compiled and summarised into Table 2. In reference to the scope of the thesis, all invoicing related to Xerox activities outside of office equipment supplies was left unconsidered.

Table 2: Xerox Oy Carrying Cost of inventory, September 2012

Capital Cost	Fixed costs	Handling	Transportation	Holding Cost%
120 684,46 €	697,13 €	9 991,88 €	31 757,93 €	8,86%

As mentioned in Chapter 2.3, the average holding cost of American companies is around 30 per cent of the capital cost. In the case of Xerox the holding cost, which in this case is caused by handling plus fixed costs, is considerably lower as the capital cost of inventory is very high. However, partially due to the low relative delivery ratios of Xerox customers, the transportation costs of supplies are as high as 26,2% (transportation cost divided by capital cost) of capital cost. Especially considering the amount of deliveries with a less than optimal amount of supplies, particularly in the case of Customer B, the total invoiced amount of transportation costs may be reduced by optimization.

4.3 Performance analysis of Xerox order management

The balanced scorecard is an effective tool for compiling data of different aspects of an organization and analysing it from several viewpoints. The balanced scorecard in its original form was introduced by Robert Kaplan and David Norton of the Harvard Business Review in 1992, the purpose being to measure the objectives and targets of a company and creates a holistic business analysis, mostly from an organizational standpoint (Johnston & Clark 2008: 362). The tool is useful in measuring and illustrating operational performance, and its ideals will be adapted to further demonstrate the case of Xerox order management.

The adapted balanced scorecard for measuring performance, as referred to in Figure 6, has four primary measure indicators: financial, external, operational and development. Financial performance measures may include traditional indicators such as total cost, relative costs per customer, revenue or relevant operational costs. External measures are mostly intangible values that may be measured qualitatively, such as customer retention and satisfaction, service levels, customer feedback or corporate image. On the other hand, operational measures indicate performance in physical activities such as lead time, personnel availability, on-time deliveries and other similar service-related metrics as discussed in Chapter 2.5. Finally, development metrics measure the involvement of personnel and management to improve and implement internal processes, measuring factors such as improvement suggestions, implemented plans and process innovation (Johnston & Clark 2008: 360-363).

The most relevant financial measures to note for Xerox's order delivery performance measurement are cost per customer and cost per delivery. These metrics are available through adding together all elements of the carrying cost of inventory from Table 2 and dividing them respectively with the amount of customers and deliveries, as referred to in Table 1. However, these indicative costs only depict the value added by external partners such as DSV, and do not account for the activities of the Xerox CSO team. Regardless, it is relevant to see the data from a decision-making standpoint.



Figure 6: The adapted balanced scorecard (adapted from Kaplan & Norton, 1992 in Johnston & Clark, 2008: 361)

Applicable external measures for Xerox's ordering process are customer satisfaction, feedback and service levels. For their largest accounts, Xerox has been tracking customer satisfaction statistics through relationship surveys conducted on a biannual basis. In addition to the surveys, the company also has a web service available for feedback regarding the Xerox Welcome Centre service agents. These ratings are tallied on a quarterly basis to monitor service performance and customer satisfaction (Xerox Global Citizenship 2011). These externally provided service metrics are supplemented with operationally measurable statistics such as lead time and delivery timeliness. The statistics are tracked in the Xerox SAP-system, where each delivery is assigned a quota to reach. Furthermore, internal development measurements are tracked with annual staff satisfaction surveys. The collected data is then analysed by the Xerox Oy human resources team before presenting the results to management.

In order to fully embrace the performance-driven measures model, certain targets must be set against which to measure the performance. Similar to ROP's and all other operative standards, these targets are handed to Xerox by the European corporate management team. The analysis results required for the balanced scorecard may be found in Appendix 2, where the targets were provided by Xerox when available.

As evidenced by the balanced scorecard in Appendix 2, the company isn't currently tracking all the metrics presented in the study, particularly the financial measures. This could be developed by assigning lower target values to service costs and estimate when the actual values reached would gradually match the newly provided targets. However, this would require a different approach to the timing of order deliveries, potentially affecting activities measured by operational metrics which have been particularly efficient within the study period.

Furthermore, as demonstrated with the value chain in Chapter 2.1, the linkages between the different parts of the operation are instrumental to surveying the entire process. The same goes for performance management, in which demonstrating linkages between measures supports making quality decisions and strengthening the strategy (Johnston & Clark 2008: 366). For instance, the high figures in customer satisfaction may be interpreted as a direct result of high quality performance in operational measures as well as the high relative financial values.

Conversely, high figures in escalation success may have a negative effect on staff satisfaction, as an extra amount of effort is required to keep supplies costs low – which in turn would affect the financial measures.

Operational measures such as lead time and on-time delivery have had a positive effect on customer satisfaction. Simultaneously the operational costs such as handling, distribution and warehousing are relatively high proportionate to the total inventory value. This could also be linked to the availability of staff or processes to coordinate the orders. The aforementioned linkages have definitely had an effect on the performance and financial viability of the current Xerox order delivery chain, but as previously indicated it has not been properly researched up to this point. While Xerox has several viable performance indicators prepared, as demonstrated in Appendix 2, the company has yet to effectively insert the intangible measures into the fold. In addition, Xerox could attempt to survey its employees more frequently on innovation in service delivery, as this might further add to the practical application of the order delivery process.

5 Conclusion

Inventory management is an art of allocating resources within the supply chain to create value for the other facets of the chain. The application of inventory management is very industry and business specific, as it is not possible to simply possess an inventory without a specific plan how to manage it and for what purposes. The cost of an inventory is an obvious performance indicator, but it is of utmost importance to recognize the nature of business in order to fully define what inventory is for the company.

One of the most important parts of quality customer service operations is to achieve a sustainable level of consistency (Johnston & Clark 2008: 218). For this very reason, the current operating model of upholding separate, subjectively upheld order management methods is unsustainable. Xerox Oy faces decisions that require a more holistic valuation of the service business and its strategy. At this time it is not plausible to fix individual facets of the company's operations, because the effects will ripple into other parts of the organization, and it is up to management to make executive decisions on the importance of each task.

Upon further review of the case study at hand, much of Xerox's inefficiency issues in regards to order delivery management have to do with the company's internal ordering processes regarding high-volume customers. Due to the order volumes that the company faces on a periodical basis, it is not feasible to provide optimized service for each customer to the degree that the amount of individual deliveries might be drastically reduced. Furthermore, as 60 per cent of customers only ordered two units or fewer within the period, it is not feasible to artificially increase efficiency by grouping orders together from a longer time period for those customers.

However, for customers that are experiencing the inefficiency of the current order delivery system the compounded benefit of improving the process is considerable. In the case of Customer B and its several likenesses, the singular amount of orders made via telephone to the Xerox Welcome Centre is far from desirable. When approaching the system from the customer's point of view, it is most definitively revealed that some level of optimization is required.

As argued in Chapter 2.2, it is clear that companies have different requirements when it comes to inventory management. In these customer cases presented in chapter 4.2, Customer C has the most need for keeping constant stock available as their business is dependent on keeping a work-in-progress buffer inventory available. In all cases, most of the issues with profitability stemmed from poor delivery efficiency ratios, as far too few products were delivered per delivery in order for the transportation to remain viable.

One main problem that Xerox needs to solve in its customer inventory management process is its relationship with logistics service provider DSV and their involvement in the value chain process. Due to Xerox's commitment to customer service levels, the company promises its customers a maximum three-day lead time for supplies deliveries. This causes an increase to the total cost of ownership of the value chain, as it is not the responsibility of DSV to make decisions on deliveries on behalf of Xerox and their service requirements.

However, if DSV were in some cases to be given one-to-two additional days to organize an individually larger delivery, the relative price per product delivered would decrease. Consequently, this would require sacrifices in service, which is one of Xerox's differentiation points. The service loss would amount to a longer lead time for the customer upon making the supplies order, but their benefit would then be receiving more supplies per each individual delivery. From the viewpoint of the Xerox service philosophy, it is a decision that warrants consideration.

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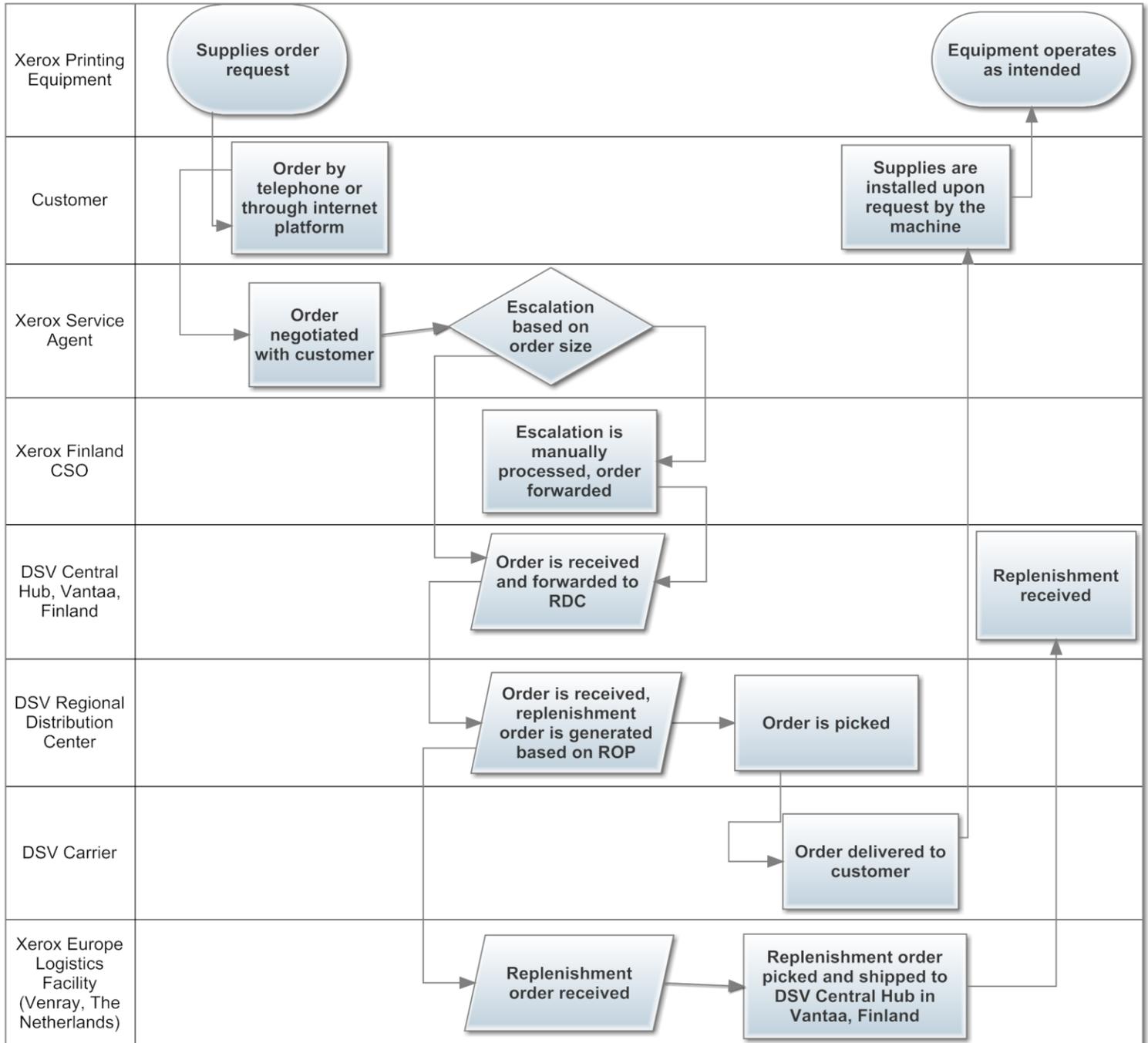
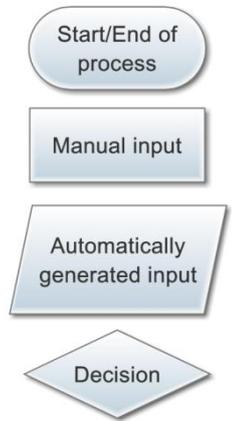
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Appendix 1. Xerox Order Management Flow Chart



Appendix 2. Performance indicators at Xerox Oy, September 2012

Financial	Target	Actual
Cost per customer	N/A	89,98 €
Cost per delivery	N/A	29,69 €
Escalation success	5%	4,9%
DSV Operational costs of total inventory value	N/A	35,2%
External	Target	Actual
Customer Satisfaction	95%	100%
Operational	Target	Actual
Delivery Accuracy	100%	100%
Delivery Timeliness	100%	100%
Development	Target	Actual
Staff Satisfaction	100%	N/A
Staff Innovation	N/A	N/A