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School of Management

UNIVERSITE CATHOLIQUE DE LOUVAIN
LOUVAIN SCHOOL OF MANAGEMENT

**Which organization model, centralization or decentralization,
suits a company best?**
Case study of the company Rexel

Supervisor:
Professor Per Agrell
Professor Christophe Lejeune

Project Master Thesis submitted by
Jérôme Nederlandt

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"Once upon a time it was not relevant to ask managers 'Is your organization centralized or decentralized?' but, rather, 'In what direction is it going this year?' There seemed to be a cyclical process at work"

Carnall (1990)

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Abstract

Centralization and decentralization have been recognized as important strategical decisions and have therefore been largely reviewed in the literature. A company can indeed benefit in many ways from these two different organizational models. Since these two strategies are different, their advantages and disadvantages are generally opposite and depend on many factors.

The aim of the thesis and its problematic was therefore to tackle this thematic through a case study, the company Rexel and provide some meaningful recommendations to managers. The methodology used along this thesis can be divided in three main steps. Firstly, a careful review of the literature has been carried in order to put the main pros and cons of both strategies forward. Secondly, the company Rexel was studied in the Netherlands and Australia. Based on the qualitative and quantitative results collected from this case study, different analyses and conclusions were drawn. Thirdly, a comparison between the literature and the applied findings was undertaken. The objective was to determine to which extent the theory meets or differs from the practice and what could be added to it.

The results from this work confirmed some of the literature findings and disconfirmed some others. It indeed appeared that the theory was not always observed and applicable. Some additional findings were also gathered and completed some of the points discussed in theory. At the end of this work, conclusions and recommendations were developed, explaining what can be expected from a centralized and decentralized system and how a company can benefit from these two models.

It should however be kept in mind that these findings are based on Rexel, a large and worldwide company selling electrical devices and services. As a result, all the results might not be applicable to other businesses and markets.

Key words: supply chain, centralization, decentralization, warehouse, inventory, transport, purchasing, service level, human resource, corporate social responsibility

Table of Contents

1	Introduction	1
1.1	Motivation	1
1.2	Research question	2
1.3	Limitations and extensions	2
1.3.1	Limitations	2
1.3.2	Extensions	4
2	Methodology	5
2.1	Literature review	5
2.1.1	Definition	6
2.1.2	The historical evolution of centralization and decentralization	6
2.1.3	The advantages of inventory centralization	9
2.1.4	The advantages of inventory decentralization	14
2.1.5	A mixed or partially centralized inventory system	18
2.1.6	The different purchasing systems	20
2.1.7	Human resources	23
2.1.8	Corporate social responsibility	24
2.1.9	Theoretical conclusions	27
2.2	Methods	29
2.2.1	Overall	29
2.2.2	Research question and problematic	29
2.2.3	The qualitative approach	29
2.2.4	The quantitative approach	30
2.2.5	Data collection and analysis	31
2.2.6	Conclusions and recommendations	33
2.3	Theoretical frame	33
3	Analysis and results	35
3.1	Overall	35
3.2	Rexel case: the company description	35
3.3	Rexel Netherlands	37
3.3.1	Strategy	37
3.3.2	Inventory	40
3.3.3	Transport and distribution	43
3.3.4	Purchasing and sales	46
3.3.5	Service level	49

VIII.

3.3.6	System	51
3.3.7	Human resources	53
3.3.8	Corporate social responsibility	55
3.3.9	Case conclusions	56
3.4	Rexel Australia	58
3.4.1	Strategy	58
3.4.2	Inventory	59
3.4.3	Transport and distribution	59
3.4.4	Purchasing and sales	60
3.4.5	Service level	61
3.4.6	System	61
3.4.7	Case conclusions	61
4	Discussion	63
4.1	Research findings	63
4.1.1	Literature findings	63
4.1.2	Applied findings	64
4.1.3	Comparison between literature and the field	67
4.2	Managerial findings	71
4.3	Critique	74
5	References	75
6	Appendix	Error! Bookmark not defined.

1 Introduction

1.1 Motivation

The incentives for companies to focus on their supply chain have substantially increased over the last years. Indeed, a company cannot be strongly competitive without paying attention to its inventory costs, distribution costs, service level and other aspects parts that constitute its chain. It appears that up to 30% of a company's total logistical costs (that Christopher (2005) describes as storage, obsolescence, damage, deterioration, shrinkage, insurance and management costs) can be related to inventory management (Gattorna and Walters, 1996, p. 127). This highlights the importance of having a lean and efficient supply chain management. As a result, many research have been led in this field to develop managerial techniques and strategies. Among them, many authors tackled the topic of network centralization and decentralization.

This topic of network (de-)centralization has indeed gained in popularity and has been subject to many studies over the last years. Many papers (such as Schmitt et al. (2015), Munson et al. (2010), Wanke (2009) and Wanke & Saliby (2009)) highlight the advantages of those strategies, putting forward the costs reductions and other benefits a company could obtain. However, a consensus on which strategy is better cannot be reached. Indeed, the answer is different for each company as the business, the expectations from the board and the environment all influence on which strategy would be the most suitable (Cummings 1995). This also means that this strategy can change in time and should therefore been periodically reviewed (Cummings 1995).

In the literature, the research (mentioned above) generally converge towards a consensus. The network centralization and especially the inventory consolidation is mainly about a reduction but will generally increase the distribution costs and decrease the service level. On the other hand, a decentralized system will give the opposite, knowing an increased service level rate, decreased transportation costs but higher inventory costs. However, in some situations and some conditions, the above might not always be true. The purpose of this work is therefore twofold. First, the aim of the literature review is to get a clear understanding of what the researchers have found regarding the advantages and drawbacks of a network centralization and decentralization. The objective is to achieve a relevant comparison between both organization types. Secondly, this literature review will be compared to a case study, the analysis of the French company to see to which extent both sides meet or differ. As this company's policy has been switching towards a centralized system, the goal of this thesis is to measure the effects of

such strategy in terms of costs, the inventory, the purchasing and the human resources and then, to confirm or refute the theoretical findings developed in the literature review. To achieve this, the analysis of Rexel in the Netherlands and in Australia will be carried.

1.2 Research question

The research question that will be developed in this work will thus tackle the topic of centralization and decentralization. The aim is to study, both theoretically and practically, the advantages and disadvantages of these organizational models. Then, the objective is to highlight the main differences and similarities between the literature and the field. Eventually, some recommendations and conclusions will be put forward, based on the findings made all along this thesis thanks to the literature review and the Rexel case. The objective behind this is to help managers at finding which organizational structure suits their company best and what benefits can be expected from it. As a result, the research question is formulated as follows: “*which organizational model, between centralization and decentralization, suits a company best? Case study of the company Rexel*”. The point of this question is not the find a unique solution and answer. The aim is rather to nuance and explain in which situations an organizational model can be more suitable for a company than another by quoting what would be the pros and cons of such model. Eventually, the content of this work can be used as a managerial tool for companies considering switching to a more centralized or decentralized supply chain system, depending on their needs, expectations and their market.

1.3 Limitations and extensions

1.3.1 Limitations

The network centralization is a pretty wide topic, as a result the scope of this work is mainly limited to the field of supply chain. Other aspects of a network centralization will also be tackled such as the human resources and the corporate social responsibility (CSR) since they were put forward during the case, thus assumed relevant. However, other departments of a company such as IT infrastructures, finance marketing for instances are thus beyond the scope of this study. For example, the banking industry is highly connected with this centralization/decentralization matter (see Yang et al. (2012)).

Also, most of the (peer-reviewed) papers used for this literature review are from online databases (ScienceDirect and EmeraldInsight) made available by the Université Catholique de Louvain (see 2.2). Using other databases could have potentially focused more on some other aspects of this thematic. However, the theoretical content obtained for this work has been assumed relevant enough to tackle the cases afterwards.

Regarding the applied part, the analyses made in this thesis are limited to two study cases from the company Rexel. In order to have a diversity in terms of findings and results, the first case targets Rexel in the Netherlands while the second case tackles Rexel in Australia. The aim was to analyse two different markets. However, this remains limited to one single company. As a result, even if the findings were various, they may not be true or applicable for any company in any kind of business. For instance, Rexel can be considered as a large company (see 3.2). Consequently, the findings of this work may not all be applicable to SMEs as differences exist between these two types of companies (see the work of Pedersen et al. (2012)). Also, the products sold by Rexel are electronical devices. Companies selling other type of goods, with for instance food or products shorter life cycles, could obtain different results than the one presented here.

One of the most restrictive limitations for this work was the lack of important and relevant data. This means that not all the data needed could be collected for a complete and full analysis, especially at the quantitative level (see 2.2). The reason behind it was that while qualitative and quantitative data could be generally gathered regarding the Netherlands case (except for the data prior to 2012), Rexel Australia information was more difficult to obtain. This can be explained by the fact that in the Netherlands, the centralization process already began a few years ago (in 2012, see 3.3). Consequently, the company had the time to measure, collect and quantify the evolution of its organization. On the other hand, in Australia, the centralization process mostly started one year ago. As a result, not much information nor data has been gathered yet. This data collection was even made more complicated since the databases of the branches and the DCs in Australia are not all up to date, making analyses hard to make. In addition to this, Rexel Australia is already giving up on the fully centralization model to go back to a more mixed organization (see 3.4.1) which means it is not sure data about the centralization will ever be really collected. Besides this time frame issue regarding the data collection, some managers in both countries recently started to work at Rexel. Consequently, they were not aware of all the results made over the last years. Some figures from the year 2013 and before could therefore not be found. Finally, the DC in Australia and in the Netherlands

had some other priorities which were thus preventing the employees from collecting and analysing the results from the centralization. Even if these employees believed in the added-value of quantifying and measuring such information, they had not much free time available for it. For instance, Rexel Netherlands managed to obtain a bigger bargaining power with its suppliers. However, a real study of the potential discounts with the suppliers and the savings that could be made out of it were acknowledged by everyone as adding value but nobody spent time on it. All of this thus limited the quantitative approach of this work. The qualitative approach is thus the main part of this thesis.

1.3.2 Extensions

This thesis is mostly focusing on the retailer point of view, since Rexel is one itself. However, other decision makers can or should also be analysed. Indeed, Anupindi and Bassok (1999) develop in their paper that the manufacturer profit and benefits may vary depending on the inventory centralization degree at the retailers. Therefore, deepening the topic further by looking at the manufacturer point of view could be a relevant next step to this work.

As developed in the limitations above (see 1.3.1), mainly two databases have been used for this literature review. Consequently, investigating other databases than the ones made available by the Université Catholique de Louvain could potentially lead to other theoretical findings that would emphasize other parts of the supply chain involved in this (de-)centralization. This could thus help in formulating other managerial recommendations.

Rexel being a large company selling electronical devices, it would be interesting to do the same quantitative and qualitative analysis for other kind of companies. For instance, study the case of a SME selling the same type of products or target totally other businesses as the food industry or the pharmaceuticals, with different product life cycles. A comparison could then be made, highlighting the similarities and differences among the different kind of businesses.

In the theoretical purchasing section (see 2.1.6), the purchasing strategies studied are the all-units and incremental discounts. Studying other types of discounts could therefore potentially lead to additional findings and conclusions.

Finally, while for the Netherlands a quantitative and a qualitative analysis has been carried, the case of Australia has only been qualitatively discussed (see 2.2 for the reasons behind this). Consequently, a quantitative analysis could be carried to formulate further findings about that Rexel Australia case which could bring additional information to this work.

2 Methodology

2.1 Literature review

The concepts of centralization and decentralization have been widely reviewed in the literature over the last years. Many different authors have highlighted the pros and cons of both strategies, mentioning the cost reductions and different benefits those organizational models offer to a company, depending on its needs and expectations.

Schmitt et al. (2015) and Wanke (2008) listed and developed in their papers some of the major drivers behind a centralized and decentralized system. The former is about the risk pooling effect (developed in the point 2.1.3.) while the latter is more about a risk diversification effect (developed in the 2.1.4.), putting forward the advantage of both strategies. They also explain how the risk profile of a company might influence its choice towards those two organizations. However, a consensus on which strategy is the most efficient cannot be reached. Cummings (1995) shows, historically, how those two systems have always co-existed. He explains how a firm may have to choose between these two organizations types based on its own culture and objectives while taking into account the environment in which it evolves. One could therefore conclude that one strategy will not always be better than the other since the internal and external environment of a company constantly changes.

The aim of this literature review is to study and deepen the scientific papers and research already made in order to understand the different impacts that the centralization and decentralization can have on a company, mostly under an inventory point of view. However, since many key aspects have to be considered while choosing one of those strategies, purchasing, the human resource, the IT and other departments of a company can and should also be taken into account. Consequently, being aware of as many variables as possible can help the decision maker in choosing the most suitable system for his company.

The literature review is structured as follows: first, a definition of both concepts, centralization and decentralization, will be set. Secondly, a description of the historical review will recall how the worldwide trends have evolved around those two strategies. Thirdly and fourthly, a description of both strategies, putting their advantages and disadvantages forward, will be established. Then, the purchasing, the human resource and the corporate social responsibility will be tackled. Finally, a conclusion summarizing all the literature findings will be written.

2.1.1 Definition

It is not clear when the concepts of centralization and decentralization first appear in the literature. Others believe it makes more sense to only consider those concepts from the modern industrial organization. Since those terms have been used many times through history and gained in importance lately, defining them is relevant before pursuing this thesis.

Cummings (1995) defined those concepts as follows: *“the term centralized indicates that authority to make important decisions lies towards the “head” or center of an organization, while conversely decentralization implies more autonomy, whereby authority is vested in those further removed from the center”*. For Chanson & Qu  lin (2013), the main difference lies in the transfer of responsibilities: *“as far as intra-firm (or internal) boundaries are concerned, headquarter or division levels may be responsible for an activity. Transfer of functions or activities from headquarter to division may be called decentralization”*.

Those definitions show that when considering both strategies, a decision maker has two choices: either he decides to pool most of the responsibilities at a single central level, or he decides to delegate those to lower levels running on their own. Consequently, this responsibility transfer represents one of the crucial differences between both systems. Cummings (1995) and Lee & Jeong (2009) have however pointed out a third choice: a company could also run with a system that lies between the two main organization types defined above. Indeed, resorting to a “mix structure” or a “partially centralized system” can also be a possibility for a company. Lee & Jeong (2009) define this as a system *“where multiple central warehouses exist and a central warehouse fulfills the aggregated demand of stores”*. All of this will be discussed in the next sections of this work.

2.1.2 The historical evolution of centralization and decentralization

There has been a time when people viewed “decentralization” as a new trend. Indeed, Cummings (1995) wrote in his paper that *“an emancipatory movement, away from centralized structures, was taking place in the 1980s”*. The author says that at that period in the United States, times were difficult: businesses were struggling to be efficient, productivity was going down and the foreign competition was hard in the late 1970s and early 1980s.

As a result many business consultants worked on the subject and, led by Peters & Waterman (1982), they came to the conclusion that decentralized structures would achieve a better competitiveness than under a rigid centralized bureaucracy. As a result, many authors around the world began to follow the work of Peter and Waterman. This increased the popularity of the decentralized organizations: "*now the wind has turned and even many of the largest companies are scurrying to turn themselves into confederations of small business units*" (Goldsmith & Clutterbuck, 1985, p. 40). Step by step, people started to believe that decentralization represented the door to a new world: "*new political parties, new philosophies, and new management techniques sprung up and explicitly attacked the centralist premises of the previous ruling paradigm*" (Toffler, 1981, p. 268). It was clear that at that time, everyone believed in the efficiency of this new structure (Stoner & Freeman, 1989, p. 323). Unless a drastic change would occur, nothing could stop the trend from growing (Brooke, 1984, p. 340). Cummings (1995) explains that many companies decided to expand their activities and to reorient their strategy by privatizing the organizations previously controlled by the state. Things were thus on the move: most of the centralized companies were switching to a decentralized structure (Naisbitt, 1982, p. 97).

As we read the above, we could believe that in the 1980s most of the organizations were moving towards a decentralized structure, leaving the centralized ones behind. However, if we take a step back and have a broader look over the last 200 years, one could notice that the evolution has not always been that linear. Indeed, many back and forth movements have occurred among this duality between centralization and decentralization. The following explains this "pendulous movement" (as Cummings (1995) refers to it) in more details.

In fact, in the 1850s in the United States, centralization and decentralization began to gain in popularity. More precisely, the construction of the Erie railroad in 1854 is considered as one of the cornerstone of the decentralization conception (Kathawala & Lingaraj, 1990, p. 53) while for some others, this construction represents the first models of centralization (Chandler & Salisbury, 1965). Both concepts appear together, as they are the two different faces of a coin.

In 1916, Henri Fayol (1949, p. 33) declared that "*centralization belongs to the natural order of things*". In the 1920s, this "natural" order of things has however been disrupted since General Motors and DuPont both developed the first major decentralization plans for manufacturing concerns. Chandler believed that it was General Motor's reforms, around 1927, which triggered the trend to decentralize in the United States (Chandler, 1962). While most of America's largest firms decentralized their activities by the end of the 1950s (Chandler, 1969), people started to

turn around in the early 1960s and began to centralize again since decentralization did not show the expected efficiency (Haimann, 1962). As the technologies improved, people believed this would impact the organizations: some authors said these technological advances would foster a re-centralization of the functional areas (logistical systems, data-processing activities) while the other organizational structures would keep decentralizing (Dearden, 1967; Herbert, 1965). On the other hand, some other authors believed that the new technologies in communication would convince the top-management to centralize their structure again as the information was now easier to collect (Buick, 1964; Leavitt & Whistler, 1958). In the 1960s and 1970s, most companies kept their administrative services centralized while decentralizing both their function areas and their supplier-buyer relationships (Kathawala & Lingaraj, 1990). Even if in the 1980s, decentralization was seen as a "buzzword" (Toffler, 1981) and a "megatrend" (Naisbitt, 1982), companies started to re-centralize their activities again (Ambrosio, 1993; LaPlante, 1992). Indeed, in the 1980s, as the information technology kept on improving and as decentralization showed weaknesses, large companies decided to gather their information systems (Margolis, 1993; Maglitta & Mehler, 1992). All this pendulous movement has been perfectly summarized by Carnall: *"Once upon a time it was not relevant to ask managers 'Is your organization centralized or decentralized?' but, rather, 'In what direction is it going this year?' There seemed to be a cyclical process at work"* (Carnall, 1990, p. 20).

The key point to remember from this historical review is that the world is not heading linearly towards one direction, may it be centralization or decentralization. Instead, there is a "pendulous" movement that goes back and forth depending on the environment evolution such as new technologies, new managing techniques, and new ways of thinking or even new trends.

In the literature, most of the papers found refer to inventory matters. However, other parts of a company may also be centralized. As a result, the next section will focus on the inventory centralization while the following sections will, on the other hand, focus on other key aspects that might be affected by the two organization types, such as purchasing and the human resources.

Centralization and decentralization can be compared under different aspects regarding the inventory. The two following chapters will therefore bring the main strengths and weaknesses of both strategies and also analyse the major differences related to the cycle stocks savings, the safety stocks savings, the impact on distribution costs and service levels and the inventory costs overall. These findings are mostly based on the work of Schmitt (2015), Wanke & Saliby (2009)

and Wanke (2009). In their paper, Wanke and Saliby (2009) distinguished the centralized system from the decentralized one using different allocation rules. The inventory centralization results are studied under Tyagi & Das' (1998) allocation rule while the inventory decentralization is studied under Ballou & Burnetas' (2003) allocation rule (see Figure 1 below, from Wanke & Saliby's work (2009)). The reader can find below a representation of these allocation rules.

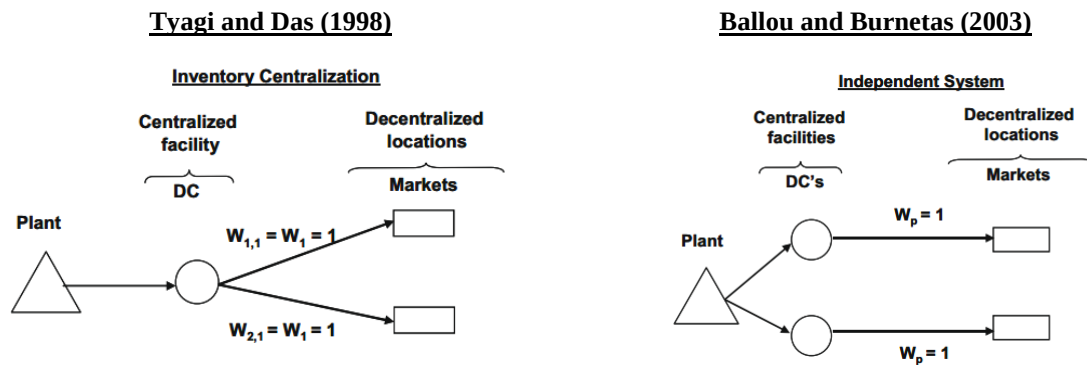


Figure 1

Different allocation rules (source: Wanke & Saliby 2009, p 682)

Where $W_{i,f}$ is the proportion of mean demand during one time period transferred from decentralized location i to centralized location f

and $\rho_{i,j}$ is the correlation of demand between decentralized locations i and j .

This Figure 1 shows that under Tyagi and Das, the case of two decentralized locations are served by only one single facility while under Ballou and Burnetas (decentralized/independent systems), the two decentralized locations are served by two distinct facilities.

2.1.3 The advantages of inventory centralization

Nowadays, more and more companies realize the importance of having an efficient supply chain. Indeed, ensuring lean and smooth processes can help the firms to potentially reduce significant costs. Evaluating and managing those costs is therefore essential for the survival of those businesses (Christopher, 2005). Consequently, handling the inventory properly is a key

element to become efficient and competitive on the market¹. In 2005, Wei-shi Lim also recalled the key importance of the warehouse consolidation in the logistical strategy.

To summarize in a few words, inventory centralization is mainly about pooling the demand (Evers, 1999) into one or fewer facilities. The literature has showed that stocks should be consolidated at the facility with the smallest standard deviation of lead time, and demonstrated that the distribution costs would generally be higher than in a decentralized system (Wanke, 2009).

Square root law

When considering the inventory centralization, different advantages may be put forward, the square root law being one of them. This square root rule is a crucial benefit from a centralized system as it demonstrates the decrease in carrying costs at the safety stocks level (e.g. Ballou (1999), (Mahmoud, 1992; Croxton & Zinn, 2005). This rule is given by Maister (1976) and his formula $X_2 = X_1 \cdot \sqrt{N_2/N_1}$ where N_1 and N_2 are respectively the current and expected number of facilities and where X_1 and X_2 are respectively the current and the expected inventory². Mahmoud (1992) however clarifies this point by saying this is not always true as it depends on the spatial settings and assumptions taken (such as uncorrelated sales demands and identical variance of sales demand at the locations). Bordley et al. (1999) states that “*the lower variance of the aggregate demand can reduce the chances of stock-outs*”. E. Melachrinoudis et al. (2005) explain that, contrary to what the literature generally says, the transportation costs can potentially be reduced thanks to bigger volume shipments and there is the benefit of an increased negotiation power with the carriers. The handling costs can also be lower since the products are picked and stored in larger quantities. Safety stocks needs are reduced (Zinn et al., 1989), the delivery precision and information are increased (Abrahamsson, 1993). These are indeed the key advantages that a centralized system offers.

Risk pooling effect

The following will develop in more details the pooling effect as it is a crucial and the main advantage of the inventory consolidation.

While studying the supply chain of a company, it is interesting and important to take uncertainty into consideration. Such uncertainty might take place on two different levels: at the demand

¹ This is also why “inventory” and “warehousing” are generally highly connected in the literature (Baker, 2007; McGinnis & Kohn, 1998).

² D. H. Maister proved this mathematical formula, see Maister (1976).

level or at the supply level (Schmitt (2015)). Under demand uncertainty, Eppen (1979) shows the benefit of a risk pooling effect in a centralized system, which will reduce the expected cost. On the other hand, under supply uncertainty, the risk diversification effect is more pronounced and therefore favours decentralization if one decides to open and use more facilities (Schmitt (2015)). This effect will however be developed below, in the next chapter.

Demand pooling is a concept that has been largely reviewed in the literature. Many authors have worked on this risk pooling effect and showed how and in which situation one can benefit from it. Working on Eppen's model, Schmitt et al. (2015) developed two theorems in the case of a stochastic demand and a deterministic supply. The first theorem states that the risk pooling effect highlights the advantage of using a centralized system. Indeed, in this case, centralization reduces the optimal expected cost by a square root factor (a proof of this is given by Eppen (1979)). The reader can find more information about this "square-root law" which reduces the safety stocks by reviewing the seminal works of Maister (1976), Zinn et al. (1989), Evers & Beier (1998), Tyagi & Das (1998), and Das and Tyagi (1999). The second theorem from Schmitt (2015) states that the cost variances at optimality are equal for both systems under a stochastic demand.

Key variables

In their study, Schmitt et al. (2015) also wanted to understand what were the key parameters that affect this risk pooling effect. They found four main variables: the demand uncertainty, the recovery rate, the supply disruptions rate and the penalty cost. They went further and developed in their paper that the more the demand is uncertain, the more pronounced the risk pooling effect will be. If the recovery rate is high or the supply disruptions not frequent, the supply uncertainty is low and therefore, centralization is better-off. Finally, if the penalty cost is low, the risk pooling effect increases.

Next to this demand pooling effect, other variables can be highlighted as favouring a centralized system and having a clear impact on the supply chain of a company. For instance, Weiskott (1998) explains that the consolidation strategy makes even more sense in the case of products with high value and low weight types as most electronic components. In this case, the distribution costs are meaningless compared to the inventory costs. Following this idea, Wanke & Zinn (2004) recalls that high density cost products are generally costly for the inventory and easy to move. Therefore, centralization appears to be a relevant choice. Furthermore, Wanke & Zinn (2004) also ran a regression test to test the significance of four different variables on their relationship with the strategic decision of whether or not to centralize. Those variables were

chosen based on their literature review. It appears that two variables came out: the inventory turnover (the most relevant one) and the delivery time. The former is positively correlated while the latter is negatively correlated. This means that, regarding the inventory turnover, “*the faster the inventory turns, the more likely the firm will decentralize inventory*” (Wanke & Zinn (2004)). Jayaraman (1998) confirmed this with his results. On the other hand, the longer the delivery time, the bigger the incentive is for the company to centralize its inventory. This has also been mentioned and confirmed by Jayaraman (1998).

The effect of consolidating inventories into fewer locations has two distinct components: the safety stock and the cycle stock (Evers, 1995). The following will thus analyse how the cycle and safety costs can fluctuate depending on which allocation rule is used.

Cycle stocks savings

Wanke & Saliby (2009) demonstrate on the Figure 2 below that when inventory centralization occurs in one single facility, the cycle stocks are minimized. This is even truer for extreme values of W_1 , where cycle stocks in centralized systems are considerably lower than in independent systems. These authors illustrate this reduction in cycle stocks through the following formulas, developed in their paper (pp 682-683):

Under Ballou and Burnetas’ allocation rule:

- if demands and order processing costs are equal , the total cycle stocks at the centralized locations (CSc) are given by³

$$CSc = \sqrt{\frac{2 \cdot D \cdot P}{h}} \quad (1)$$

- if demands and order processing costs are not equal, the total cycle stocks equal

$$CSc = \frac{1}{2} \cdot \sqrt{\frac{2}{h}} \cdot \left[\sqrt{[W_p \cdot D_1 + (1 - W_p) \cdot D_2] \cdot P_1} + \sqrt{[(1 - W_p) \cdot D_1 + W_p \cdot D_2] \cdot P_2} \right] \quad (2)$$

Under Tyagi and Das’ allocation rule, the cycle stocks depend on W_1 and equal

$$CSc = \sqrt{\frac{D \cdot P}{h}} \cdot (\sqrt{W_1} + \sqrt{1 - W_1}) \quad (3)$$

As a result, when W_1 is equal to 0 or 1, independent systems have consolidated cycle stocks which are higher than the ones in a centralized system. In their analysis, Wanke & Saliby (2009) showed that these costs were 1,14 times higher for their study case.

³ Where h refers to the holding costs (\$ per time period), D_i is the mean demand during one time period at decentralized location i and P_f is the fixed order processing cost at centralized location f (\$ per order).

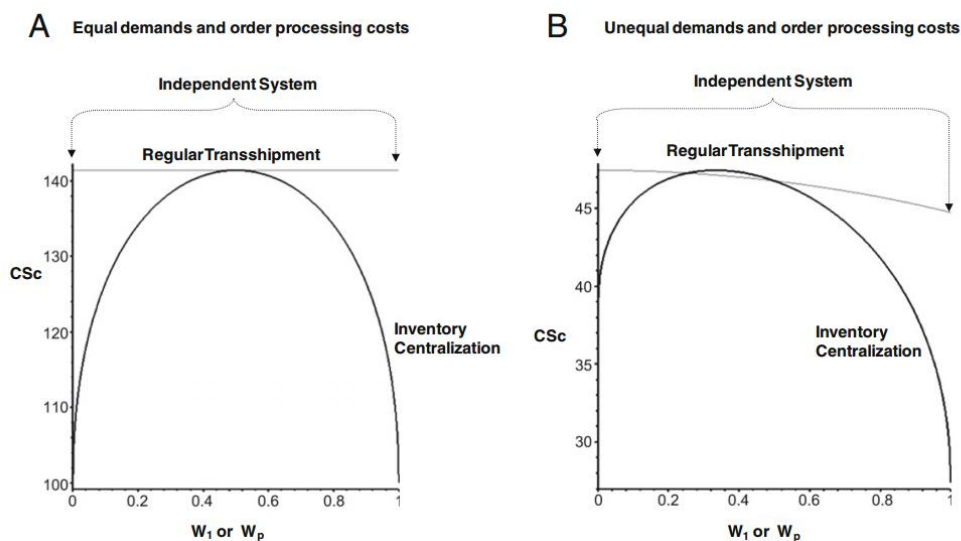


Figure 2

Impact of allocation rules/inventory-pooling models on cycle stocks (source: Wanke & Saliby 2009, p 683)

In addition to this, Wanke (2009) wrote another paper on the same topic, developing the concept of the consolidation effect. In this paper, he confirmed that, under Tyagi and Das' allocation rule and the same assumptions, when W_1 equals 0 or 1 the cycle stocks are minimized. Also, he confirmed the optimality to centralize in a single facility only and explained that the location where inventory should be consolidated is the location with the lowest P/h ratio where P represents the fixed order processing costs and h the per-unit inventory holding costs.

Safety stocks savings

Wanke & Saliby (2009) demonstrate in their paper the consolidated safety stock behaviour for both allocation rules. Their findings are that, in general, the consolidated safety stocks are always lower in a centralized system. However, in some limited situations, these stocks might be equal for inventory centralization and independent systems. That is when $\rho_{1,2} = 1$ and W_p is equal to 1 or 0 or when W_p is equal to 0.5 and for any values of $\rho_{1,2}$.

Inventory costs

Wanke & Saliby (2009) showed in their paper that despite higher transportations costs, the centralized system generally benefit from lower total costs as the inventory costs reduction is big enough to trade-off these distribution costs.

The authors emphasize on the importance of the holding costs when considering pooling the inventories. They summarize it by saying that when inventory holding costs per unit are high, items should be centralized. When those holding costs decrease, one should think about

decentralizing more by switching to independent systems. This can be summarized as the higher the holding costs, the higher the degree of consolidation should be.

Wanke & Saliby (2009) summarized the advantages of the two pooling techniques: generally speaking, inventory centralization enables the decision maker to benefit from the demand pooling effect. This is the result of consolidating at the best performing facility regarding the lead time variability. Combining the negatively correlated demands at decentralized locations at one single facility is also an advantage of this demand pooling. These demand pooling effect findings by Wanke & Saliby (2009) confirm what has been previously developed in this chapter, regarding the work of Schmitt et al. (2015). Also, the benefits for an independent system are the elimination of the “*unexpected cross-effects in terms of demand peaks (or valleys) and/or lead time delays (or anticipations)*”. Such benefit can be linked to the “risk diversification” mentioned in Schmitt et al. paper (2015).

The Table 1 below summarizes all the above, by listing the advantages and disadvantages of an inventory centralization.

Table 1

Advantages & disadvantages of inventory centralization

Inventory centralization	
Advantages	Disadvantages
- Risk pooling effect - Square root law - Handling costs reduction - Delivery precision improvement - Effectiveness for long delivery times - Effectiveness for high density costs products	- Distribution costs increase - Service level reduction - Delivery time increase - High investment costs - Difficulty to achieve economies of scale

The next section will now develop the advantages and disadvantages of a decentralized system, as done above for the centralization.

2.1.4 The advantages of inventory decentralization

Inventory consolidation does not only have benefits. Indeed, as the transportation distance to the customer increases, the delivery times and costs might increase (Das & Tyagi, 1997). Abrahamsson (1993) however argues by saying that this increase in delivery times might be avoided in a centralized system if it manages to achieve a complete assortment in the central warehouse and a smooth flow of deliveries. Moreover, the company is further from the

customer (Cooper, 1983) and might consequently have its service level decreased (Abrahamsson, 1993). This can be a serious issue as such service level is yet considered as a key performance indicator (Frazelle, 2002). Campbell (2003) explains that economies of scale might be difficult to achieve. Campbell (2003) recalls that in such situations, the headquarters suffer from higher costs resulting from delayed decisions and unresponsive support. As Pedersen et al. (2012) were studying the case of an SME, they also noticed that for this kind of company size, the huge investment of a centralized warehouse (or warehouses) can be too high as SMEs tend to have limited resources.

Risk diversification effect

While the advantage of centralization under demand uncertainty was mentioned earlier, the same reasoning can be followed for decentralization under supply uncertainty. Schmitt et al. (2015) explain in their paper that two common forms of supply uncertainty exist: “*supply disruptions (in which supply is halted entirely for a stochastic amount of time) and yield uncertainty (in which the quantity delivered from the supplier is random)*”. These authors develop the risk diversification effect with supply disruptions through their study. In their scenario, disruptions occur randomly and independently at all locations in the system. They describe these disruptions as “*disruption of an upstream supplier, failure of inbound transportation capabilities (e.g., a snowstorm or flood that shuts down rail or major roadways), transportation labour issues (e.g., a port strike), shipment quality issues (e.g., a bacterial contamination), or other major issues that interrupt material flow to a single location*”. After testing their model and analysing their results, Schmitt et al. (2015) concluded that, in the case of a deterministic demand and supply disruptions, the total system inventory levels and expected costs are equal in both centralized and decentralized systems. However, the cost variance is n times greater for the centralized system.

These findings are the opposite of the demand pooling effect where the expected costs were different (by a square root factor) but the cost variance equal (see section 2.1.3.1.). This implies that for risk-averse firms, a decentralized system is better as the variance is not changing anymore. That reduction of the cost variance is defined as the risk diversification effect. Snyder & Shen (2006) obtained the same result with their simulation, even if their model is slightly different. The intuition that lies behind this result is that a decentralized system reduces the impact from a disruption as it keeps different locations open and do not gather everything at one single (or fewer) place(s). Consequently, Schmitt (2015) explains that the impact of a disruption is smaller in a decentralized system than if it occurred in a centralized system since

all the activities are not impacted. Similarly to what they did for the risk pooling effect, Schmitt et al. (2015) listed the same four parameters that impacted the risk diversification. The output is that it is, as expected, the exact opposite as what they found for the risk pooling. This means that the risk diversification effect is increased when the uncertainty in demand decreases, the recovery rate is low, the supply disruptions are frequent or when the penalty cost is high. This confirms the results obtained by Snyder and Tomlin (2008), Tomlin (2006), and others who suggest that frequent disruptions increase the risk diversification effect.

As the scenarios with deterministic demand and stochastic supply (see section 2.1.3.2) or the other way around (see section 2.1.3.1.) have already been discussed, the remaining question is: what would the output be for the scenario where both demand and supply are stochastic? Is the risk pooling effect stronger or weaker than the diversification effect? Schmitt et al. (2015) performed a numerical analysis to compare the performance in the two systems, centralized and decentralized. They proved that even under a stochastic demand with supply disruptions, the risk pooling effect holds, which as mentioned before (see 2.1.3.1.), enables the company to reach lower expected costs. They did the same for the risk diversification and, again, proved that even under a stochastic demand with supply disruptions, the risk diversification usually (in most of the instances tested) holds. This means that decentralized systems manage to reach a lower cost variance (coefficient of variation in cost).

Schmitt et al. (2015) then decided to compare the risk pooling effect against the risk diversification effect. It appears that when one increases the number of facilities, both risk pooling and diversification effects are observed. However, they explain that the decrease in expected cost gained from risk pooling has less impact when the disruptions are frequent or when the stock-out situations are costly. On the other hand, the decrease in cost variance thanks to the risk diversification effect is always observable. Consequently, as long as the penalty costs and the disruption rate remain high, the risk diversification effect surpasses the risk pooling effect. A decision maker or a company whose profile is risk-averse would logically rather go for the decentralized strategy. This conclusion they made is really important as it highlights that even if both centralization and decentralization systems have their advantages, one can be better than the other in some situations. When the authors tried to find the situations where centralization would be optimal and better off than decentralization, they found that this was true in only a limited number of situations: 1) when the service level is very low, 2) if the firm is very risk neutral 3) and/or the system is highly reliable.

This risk diversification effect shows that centralization might not always be the best choice for a company. Teo et al. (2001), following the work of Gallego (1998), also found that the consolidation of warehouses of different characteristics may lead to performances that are far from the optimal. This has also been a finding of Lim et al. (2002) who performed an extensive numerical study. They concluded that in most cases, consolidation in a single-warehouse was always the right strategy to adopt. However, in the case of two separate inventory systems with very different cost structures, the consolidation into one warehouse led to an increase of the costs. Indeed, one had low ordering and high holding costs (more suitable for cross-docking) while the other one was more for staging the inventory.

Besides this risk diversification effect, the advantages and disadvantages of a decentralized system are generally, as expected, the opposite of those from a centralized structure. This means that for inventory decentralization, the advantages are generally a reduction in transport and distribution costs, an increase in service level and a reduction in delivery times since the facilities are closer to the customers. On the other hand, the disadvantages for the inventory decentralization are higher safety and cycle stocks and, as a result, an increase in the stock costs. All of this is developed in more details in the following section, based on the works of Wanke (2009), Wanke & Saliby (2009), Ballou & Burnetas' (2003), Tyagi & Das' (1998) and (Evers, 1995).

Impact on distribution costs

In addition to these cycle and safety stocks, some studies (Das & Tyagi (1997) and Disney et al. (2003)) highlight the importance of taking distribution costs into account when considering network centralization. The example of the two locations scenario as above (Tyagi and Das and Ballou and Burnetas' allocation rules) is taken. Wanke & Saliby (2009) demonstrated through their computations that the distribution costs are always lower in the case of independent systems compared to an inventory centralization.

Impact on service levels

A last important aspect under which the two allocation rules can be analysed is the service level. Regarding those fill rate levels, Wanke & Saliby (2009) obtain the following results. The independent systems perform better than the inventory consolidation when demands are uncorrelated and demand means and standard deviations are equal. However, when one adds the restrictive assumption that standard deviations of lead time are equal, independent and centralized systems are similar in terms of fill rate levels.

The Table 2 below summarizes all the key findings from this section.

Table 2

Advantages & disadvantages of inventory decentralization

Inventory decentralization	
Advantages	Disadvantages
- Risk diversification effect - Transport and distribution costs reduction - Service level increase - Delivery time reduction - Effectiveness for fast moving inventory	- Cycle stocks increase - Safety stocks increase - Stocks costs increase

Besides, Wanke & Saliby (2009) showed through a Table (see Appendix 1) in their paper how the correlation in the demand, the holding costs, the lead time mean and variability, the demand standard deviation are important factors to consider. Indeed, depending on the company's performances regarding those variables, a pooling technique may be more suitable than another. Managers should therefore be aware of it while making strategic decisions. Wanke & Saliby (2009) give different concrete examples to show when a technique is better than another one considering a specific business. The key points to remember here are, in the case of a "*highly, positively correlated demands from dedicated facilities with low lead time means and standard deviations of demand*" (Wanke & Saliby 2009), independent systems appear to be the choice to make (no inventory-pooling at all). On the other hand, in the case of a "*negatively correlated demands from one single facility with high and homogeneous lead time means and standard deviations of demand*" (Wanke & Saliby 2009), inventory centralization is the best pooling technique (demand pooling).

2.1.5 A mixed or partially centralized inventory system

As developed in the above, the literature generally describes the concepts of centralization and decentralization as two different strategies. It makes the reader think that the decision maker therefore has to strictly choose one or the other for the company. However, a third scenario can exist: a mixed or partially centralized inventory system.

The advantage of centralizing an organization is well defined by Lee & Jeong (2009): "*by running a central warehouse, we can reduce the variability of demands by compensating the underestimated demand of one store with the overestimated demand of another store. Eventually, the reduction of the variability of demands eliminates the unnecessary safety stock*

and this minimizes the inventory holding cost". These authors recall that Gerchak & Gupta (1991) already theoretically proved that cost reduction thanks to centralization. Many research have been led about this centralization and the game-theory to study whether or not a store should deviate (cfr. Hartman et al. (2000) and Hartman & Dror (2003). However, this inventory cost reduction is counter-balanced by the increase of the transportation costs and a decrease in service level as mentioned previously. That is why Lee & Jeong (2009) considered in their paper the case of a "*Partially Centralized Inventory System (PCIS)*", where the objective was the warehouse costs and transportation costs minimization. By warehouse costs they refer to: ordering cost, inventory cost and shortage cost. They aim to determine how many central warehouses should be chosen and to find the efficient assignment of central warehouses. In their paper, Lee & Jeong (2009) show that a decision maker does not necessarily need to choose one strategy over the other. A mixed or partially centralized inventory system can be designed to benefit from both organization types. This is what the historical review at the beginning of this paper suggests through Cummings (1995) work.

Cummings (1995) explains in his paper that the needs of an organization regarding decentralization or centralization will be contingent. As a result, an assumption is formulated by the author, saying that different "optimal mixes" may be obtained. He quoted Henri Fayol (Cuthbert et al., 1970) who stated that "*The question of centralization or decentralization is simply a matter of proportion, it is a matter of finding the optimum degree for the particular concern*" (Fayol, 1949, p. 33, underlining added). Many other authors answered to this optimal mix matter. In response to Fayol's finding, Dessler said: "*Finding the right balance between autonomy and control is the crucial issue in the art of decentralizing*" (Dessler, 1985, p. 159). In his paper, Cummings (1995) tells us that the concept of a golden mean slowly appeared: he explains that every company has its own golden mean, depending on its nature, and should be therefore found.

Another assumption mentioned by Cummings (1995) is that there is "*an ideal balance between centralization and decentralization changes, driven by changing environmental circumstances*". He explains that not everyone accepted the simple fact that a single and stable golden mean existed. Indeed, "*There is no reason to suppose any techniques -- whether centralization or decentralization (or mix thereof), will bring the organization into the neighbourhood of a genuine 'optimum', the search for decision mechanisms cannot take the criteria for optimization too seriously, but must seek 'workable' techniques for satisficing*" (March and Simon, 1958, p. 209). In his paper, Cummings explains how many authors believe

that an optimal point may exist in theory and should therefore be targeted. However, “*because the business environment is dynamic the level of this point depends on environmental circumstances, and will need reviewing throughout time as these circumstances change*” (Carnall, 1990, p. 22). Among these environmental circumstances and changes, three factors have been listed by Stoner and Freeman (1989, p. 323) as having serious impacts on an organization: influences from the business environment (i.e. market characteristics, competitive pressures, and availability of materials); size and rate of growth of the organization; and, the characteristics of the organization (i.e. the organization's culture, top management preferences, and the abilities of lower-level managers).

To summarize the above, one could conclude that even if a golden mean existed and could potentially be theoretically found, such point would evolve and change in time, as the environment changes. This target will thus move, subject to the environmental driving forces, technological developments and social contingencies. A “*pendulous movement of the "golden mean" may happen because of organizational contingencies and dynamic environmental forces*” (Cummings, 1995). This important conclusion explains many findings from the Rexel case analyses (see 3.3 and 4.1).

As previously mentioned, next to the centralization and decentralization of inventory, other factors can be considered in a company's supply chain centralization. The purchasing department of a company can also be involved and will be discussed in the next chapter.

2.1.6 The different purchasing systems

The purchasing function of a company may be centralized or decentralized (see, Munson, 2007; Vagstad, 2000; Corey, 1978). Generally speaking, most companies however realize a combination (Benton, 2007). When such combination is achieved, some call it “*centralized pricing with decentralized purchasing*” (Munson & Hu (2010)). In this kind of situation, the negotiation part with the suppliers is made with a centralized purchasing department. The contracts therefore affect the whole company. Each decentralized system has to order regarding this contract but it is free to choose the time, the quantities and the products of the order. Some smaller companies generally follow this mixed strategy by joining bigger ones (for instance the pharmacy cooperatives, Schotanus, (2007)). Schotanus et al. (2008), Reese & Pohlman (2005) and Monczka et al. (2002) give further examples and descriptions of these models). The process occurs thus in a two-stage decision process: first the company needs to decide to centralize or not the pricing, then decides to keep the purchasing centralized or not. Another third decision

could be whether to store the products in a centralized location or not. This makes thus eight possible combinations. Four only were retained by Munson & Hu (2010) as the logical ones (see Figure 3 below, from Munson & Hu's paper (2010)).

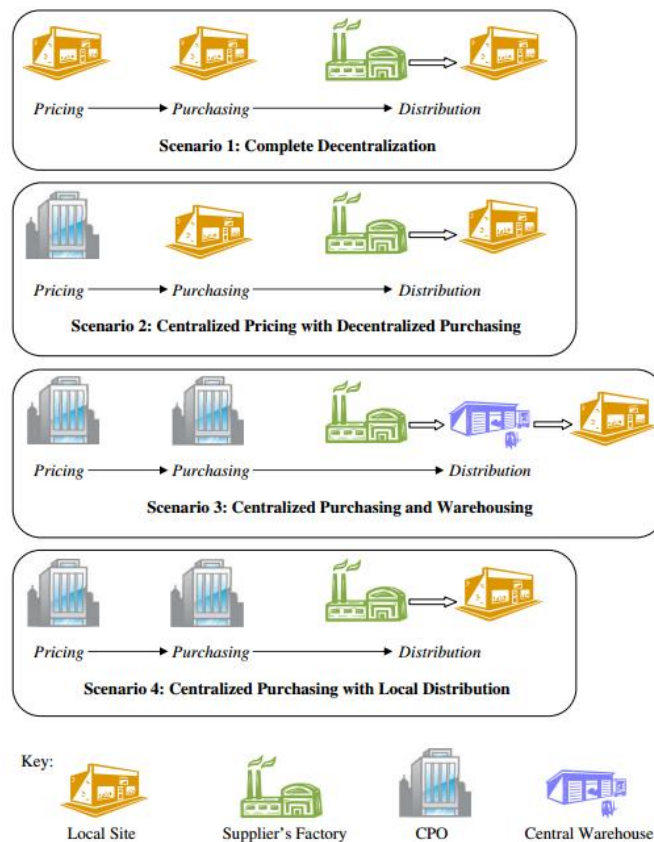


Figure 3

Flow diagram of the purchasing centralization scenarios (source Munson & Hu 2010, p 583)

One of the key reasons why a firm would prefer to purchase, or at least discuss the pricing, with a centralized purchasing office (CPO) is the benefit of quantity discounts (Munson & Rosenblatt, 1998). Many papers (Sarmah et al., 2006; Munson & Rosenblatt, 1998; Benton & Park, 1996) deepened the quantity discount purchasing problem. Other research have also tackled this problem under a different angle: taking the quantity discount as a decision variable to meet the suppliers and buyers' needs and expectations (e.g., Erhun et al., 2008; Chen et al., 2001; Weng, 1995).

Based on those research, Munson & Hu (2010) presented a numerical analysis, showing the impact of those different centralization scenarios on the purchasing quantities and costs. It appears that when quantity discounts are “all-unit discounts”⁴, the full centralization scenario

⁴ “Where the lower price applies to all units purchased, not just those above the price break” Munson & Hu (2010).

(centralized pricing, purchasing and warehousing) is the best at cost minimization (including transportation costs). However, when the quantity discounts is an “incremental discounts”⁵ type, the scenario with a centralized purchasing and a local distribution has the lowest total costs and is thus preferred.

When comparing the fully decentralized scenario with the one with centralized pricing and decentralized purchasing, no matter the quantity discount type, the latter scenario has the lowest total costs. However, this has to be discussed. Indeed, the second scenario benefits from lower inventory and purchasing costs since it orders via a centralized pricing, allowing potential better deals. However the transportation costs are higher and somehow off-set this inventory cost reduction. See Table 3 for the results from Munson & Hu’s paper (2010).

Table 3

Base case example (source Munson & Hu 2010, p 590)

Scenario	Order quantity					Costs		
	Q_1^*	Q_2^*	Q_3^*	Q_4^*	Q_5^*	Purchasing & inventory	Transportation	Total
<i>All-units discount</i>								
1	75.59	239.05	239.05	8000.00	8000.00	1,199,964	61,000	1,260,964
2	78.45	248.07	248.07	8000.00	8000.00	1,093,752	91,500	1,185,252
3 ^a	109.29	327.87	327.87	468.38	468.38	982,436	91,500	1,073,936
4	327.87	3278.69	3278.69	6557.38	6557.38	997,576	91,500	1,089,076
<i>Incremental discount</i>								
1	75.59	239.05	239.05	338.06	338.06	1,232,913	61,000	1,293,913
2	78.45	248.07	248.07	350.82	350.82	1,110,443	91,500	1,201,943
3 ^b	15.88	158.81	158.81	317.62	317.62	1,107,445	91,500	1,198,945
4	212.27	2122.70	2122.70	4245.40	4245.40	1,092,299	91,500	1,183,799

^a CPO’s lot size = 20,000 units ($n^* = 11$); single-cycle policy cost \$230 more and had order sizes of 29.81, 298.06, and 596.13.

^b CPO’s lot size = 968.74 units ($n^* = 1$); single-cycle policy was the same.

Munson & Hu (2010) also found that under the “all-unit discounts”, the order quantities tend to be higher than the respective EOQs would advise. These large quantities can then be stored at the cheaper warehouse to benefit from even bigger reductions in the inventory costs. On the other hand, the “incremental discounts” did not require to order that many quantities. Therefore, the extra set up costs that the consolidation would cause are not justified and consolidation appears to be less relevant as less economies of scale are possible.

These results are interesting as they can aid managers to understand how their purchasing centralization configuration may impact their costs and how a change in this centralization degree might affect their business. The negotiation strategies, with the supplier as the two mentioned above, therefore show to have their importance.

⁵ “Where only those units within a price break interval receive that interval’s discounts” Munson & Hu (2010).

The Table 4 below summarize the findings from this section.

Table 4

Summary of the quantity discounts impacts

Purchasing strategy	
All-units discounts	Incremental discounts
- Best scenario: full centralized scenario (centralized pricing/purchasing/warehousing) - Lowest costs, transport included - Order quantities > EOQs: more economies of scale	- Best scenario: centralized purchasing with local distribution - Lowest costs - Order quantities < EOQs: less economies of scale. Extra set up costs from consolidation not justified

Next to inventory and purchasing and as mentioned previously, another main aspect of a company that can be developed linked to centralization is the human resource department. This subject is discussed in the next chapter.

2.1.7 Human resources

Chanson & Quélin (2013) develop in their paper that some skills might be difficult to find in a workforce depending on the company's activities. Therefore, finding the right people at each decentralized structure might be complicated, even more as they might not be full-time workers. Centralizing everything there helps to reduce the number of skilled people required to achieve complex tasks as less employees are needed in total to run the warehouse(s), the central administrative costs are reduced (Melachrinoudisa et al. 2005). The learning costs and warehouse staff are, consequently, reduced too (Abrahamsson, 1993).

Another thing about the human resource is the responsibility and autonomy transfer. As developed in the definition at the beginning of this literature review (see 2.1.1), the responsibility and autonomy can be centralized at a single or fewer facilities (Chanson & Quélin, 2013). Depending on the decision maker, more autonomy can be given or not to the decentralized facilities. Such autonomy could foster creativity but would also raise higher staff and administrative costs, as explained above.

All of this makes the human resource another crucial point to consider while consolidation a company's network. The Table 5 below summarizes the above:

Table 5

Pros and cons of the human resources centralization and decentralization

Human resources centralization	
Pros	Cons
- Skilled people needs reduction - Central administrative costs reduction - Learning costs reduction - Warehouse staff reduction	- Impact from strikes

Human resources decentralization	
Pros	Cons
- More autonomy - More creativity	- Needs of skilled people increase - Potential half-time jobs - Higher staff and administrative costs

2.1.8 Corporate social responsibility

As developed in the Rexel case (see 3.3.8), the corporate social responsibility (CSR) is directly linked to a company's business. If successfully achieved, a company can benefit from its social and environmental behaviour in many different ways. The following will discuss this in more details.

Owazuaka & Obinna (2014) define the "corporate social responsibility" as a concept where companies promise to voluntarily improve the environment by working in a greener way. According to these authors, a company can truly gain in trustworthiness by its public as it shows a CSR attitude, a transparency and a good communication.

Over the last year, the CSR has gained in popularity as professionals recognized that the role of a company is not only to make profit but also to take care of the society's best interests (Owazuaka & Obinna, 2014). As a result, CSR is when companies add a social and environmental aspect to their daily business activities, working hand in hand with their stakeholders⁶ (Owazuaka & Obinna, 2014). This is thus a behaviour that has to be constant and not temporary. Labbai's definition (2007) of corporate social responsibility is: "*the continuing commitment by business to behave ethically and contribute to economic development while*

⁶ A stakeholder of the company is anyone that is directly or indirectly involved in the company's business and activities.

improving the quality of life of the workforce and their families as well as of the local community and society at large". Labbai (2007) explains that in his definition, "society" involves the company's customers.

The following will highlight the six factors developed by Owazuaka & Obinna (2014) that can push a company to having a more CSR orientation. 1) The shrinking of the government: as the governments appear to have nowadays less resources, more and more companies start to voluntary work in a more environmentally way and not of a legislation. 2) Demands for greater disclosure: the stakeholders are asking companies for more disclosure. 3) Increased customer interest: it is proven that customers' behaviour is influenced by the way a company makes business. Indeed, more than one out of five customer behave positively or negatively based on a company's CSR (perceived) activity. 4) Growing investor pressure: studies prove that investors are now taking ethical concerns into account while choosing a company in which to invest. 5) Competitive labor markets: CSR is also an attractive tool for high potential and skilled employees who not only look at the salary and the fringe benefits but also at the working conditions. 6) Supplier relations: a company can ask from its stakeholders (suppliers and customers) to behave more ethically and socially in order to keep a good reputation. This shows the positive externalities that CSR can bring with it.

In addition to these six factors, there is a win-win(-win) situation for a company having a CSR attitude. Indeed, such behaviour can provide benefits to the company but also to the community and general public and to the environment. The Table 6 below (from Owazuaka & Obinna, 2014, pp 222-223) highlights these benefits:

Table 6

The different benefits stakeholders can expect from the corporate social responsibility (source: Owazuaka & Obinna, 2014, pp 222-223)

1. Company benefits:

- a. Improved financial performance;
- b. Lower operating costs;
- c. Enhanced brand image and reputation;
- d. Increased sales and customer loyalty;
- e. Greater productivity and quality;
- f. More ability to attract and retain employees;
- g. Reduced regulatory oversight;
- h. Access to capital;
- i. Workforce diversity;
- j. Product safety and decreased liability.

2. Benefits to the community and the general public:

- a. Charitable contributions;
- b. Employee volunteer programmes;
- c. Corporate involvement in community education, employment and homelessness programmes;
- d. Product safety and quality.

3. Environmental benefits:

- a. Greater material recyclability;
- b. Better product durability and functionality;
- c. Greater use of renewable resources;
- d. Integration of environmental management tools into business plans, including life-cycle assessment and costing, environmental management standards, and eco-labeling.

Besides this and to highlight the growing importance of the CSR, Brown & Knudsen (2015) wrote a paper and explained that the market pressures influence the companies' CSR orientations. Also, the company stakeholders play a role too as they can push the company to have a clear CSR policy to respect it as much as possible in its daily activities. For instance, ensuring a greener purchasing method. This is the reason why most of the Western companies nowadays are more and more concerned about this topic and make more promises in terms of social and environmental programmes to guarantee some working and safety standards. It is also observed that international companies are generally more CSR-oriented as a response to low regulation and high risks in host countries (Börzel and Risse, 2010; Kostova and Zaheer, 1999). It is also believed that generally speaking, large firms are more involved in the CSR than the smaller ones (Bennie et al., 2007). Also, some sectors might be more CSR-oriented than others (see the study results of Brown & Knudsen (2015)). Finally, Brown & Knudsen (2015) concluded that companies from a same sector generally have the same CSR orientation and programmes, regardless of which country they are operating in.

All of this underlines that the corporate social responsibility is not about philanthropy anymore (Owazuaka & Obinna, 2014) but can really be a tool of competitiveness for a company's business as it can bring many benefits along.

2.1.9 Theoretical conclusions

In this literature review, different advantages and disadvantages of both centralization and decentralization have been put forward. The Table 7 below gives a summary of the key findings from this literature review for both organization types.

Table 7

The key findings from the literature review

	Advantages of the warehouse structure	
	Centralization	Decentralization
Inventory	- The risk pooling effect and the square root law: lower inventory - Handling costs reduction - Delivery precision improvement - Effectiveness for long delivery times and high density costs products	- The risk diversification - Lower distribution costs - Better service level - Lower delivery time - Effectiveness for fast moving inventory
Purchasing	- Lower costs in the case of all-units discounts - More economies of scale in the case of all-units discounts	- Lower costs in the case of incremental discounts
Human resources	- Reduction in the amount of skilled workers required - Administrative, learning and warehouse staff costs reduction	- Smaller impact of strikes
Corporate social responsibility	- Lower operation costs - Increased sales and customer loyalty - Greater productivity and quality - More ability to attract and retain employees - Benefits to the community, general public and environment	

However, as mentioned in the previous section, a decision maker does not necessarily have to choose between both strategies. As explained by and Lee & Jeong (2009), a mixed structure can be found in order to somehow benefit from both structures advantages.

2.2 Methods

2.2.1 Overall

In this section, the methodology used to write this thesis is described. This master's thesis was written according to a classical thesis structure: first an introduction (motivation, research question, limitations and extensions), then the methodology (literature review, methods and theoretical frame), the application (case, data results analysis and conclusions) and finally the discussion (research and managerial findings and critique). While the theoretical part of this work was mainly based on the literature review followed by a summary of the findings, the applied part was about deepening and studying the case of a company, Rexel (Cornet 2009).

2.2.2 Research question and problematic

Once the literature review was achieved, the next step of this thesis was the applied part knowing the case analysis of the French company Rexel. More specifically, Miles & Huberman (1994) explain that to be successfully handled, a qualitative analyses should be limited to a conceptual framework and a specific case should be targeted. As a result, the scope of this Rexel case study is limited to the centralization and decentralization topic. What will really be studied and developed is how Rexel achieved its centralization in the Netherlands and in Australia. In the former situation, this happened over the last four years while the latter over the last two. This thesis thus explains, describes and illustrates how these centralization processes occurred over lately. Such working method was described by Yin (2008) as relevant for a case study.

2.2.3 The qualitative approach

De Moerloose (2015) recalls that a case study can be done quantitatively or qualitatively. She explains that while the former is more about building a theory, the latter is about testing a theory. As a result, the objective of this thesis is mainly qualitative as it aims to discuss the pros and cons of centralization and decentralization and to understand in depth this context. Indeed, the final goal of this thesis is to provide recommendations for managers considering these two strategies. One other reason for choosing a qualitative approach was based on four factors, mentioned by Lejeune (2013) and listed by Miles & Huberman (1994): the great proximity with the case studied (the company Rexel where I did my internship), the will to assess the causal links from the results collected, gathering the employees' perceptions and hypotheses and the objective of interpreting qualitative data. Such approach has been carried thanks to an in-depth

analysis of the company Rexel through interviews with managers and employees (see Appendix 2 and 3). The steps of these interviews were designed, following the ones developed by Lejeune (2013), knowing: first breaking the ice, some first global questions then some more specific and precise sub-questions (“*funnel technique*”) and ending by summarizing some of the key ideas, asking for any further ideas/suggestions and then thanking the interviewee. The questions in the interviews were mostly semi-structured (see Van Campenhoudt & Quivy, 2006) and open-ended, enabling the interviewees to answer as freely as desired while still keeping a common thread. The aim of these qualitative interviews is to gather the knowledge and the thoughts from these employees (as mentioned by Lejeune (2013)) about centralization and decentralization, directly linked to their experience from the field. Based on these feedbacks, the objective was to collect enough results and information to make a clear comparison between theory and practice. Such comparison has described to which extent the field and the theory match or differ to eventually draw conclusions. While the interview is considered a relevant way of collecting qualitative information by De Ketele & Roegiers (1996), they consider this method as highly limited in time and space. On the other hand, these authors believe that reading and studying documents is one of the most powerful method to gather relevant data. This is also confirmed by Yin (2008). Consequently, in addition to these interviews, some information presented in this thesis also come from some Rexel’s documents sources (see Derycke 2014 and see 3.2).

2.2.4 The quantitative approach

However, it has also been decided to add a quantitative approach to the thesis. The reason for it is to be able to not only have qualitative results, but to also be able to quantify and interpret them. Such process is considered by Miles & Huberman (1994) as relevant for a qualitative work. Indeed, since the aim of this work is to serve as a tool for the supply chain managers considering centralization or decentralization, having some qualitative data is assumed to be enriching and an interesting support. Furthermore, Yin (2008) explains that a case study can be based on both, qualitative and quantitative data and information. Following De Moerloose (2013), such quantitative work will also bring more objectivity, rigour and precision to the qualitative part. For instance, saying that the distribution costs or that the service level have changed after the switch from one organizational model to another one is good (qualitative approach) but might not be sufficient or satisfying enough for a manager looking for concrete incentives. Indeed, in a company, managerial decisions can generally not be taken without any data to support the qualitative arguments. Since the interviews were carried with a questionnaire (see Appendix 2) mostly qualitative-oriented, the quantitative results were obtained afterwards.

Indeed, once all the information from the interviews were analysed and summarized, further emails were sent to the employees, asking for figures to quantify what had been discussed and retained during the conversations. It is important to note that a quantitative approach has only been carried for the Netherlands. Indeed, while a qualitative analysis has been made for both Rexel Netherlands and Australia, no quantitative work has been realized for the Australia case. The reason behind it is that the Netherlands had started to switch from a decentralized to a centralized model in 2012. This means that they had three years of data and information collection to describe the evolution in terms of results. On the other hand, Rexel Australia started with its centralization process one year ago and did not really track the evolution under a quantitative point of view. As a result, they did not have any relevant figures to share. They explained that this was the consequence of a sudden transition. Indeed, Rexel Australia went from the previous decentralized model to the new centralized one in less than a year (see 3.4). To illustrate this sudden and important change, they said that they went from three or four thousand SKUs⁷ to almost twenty thousand. They got a bit overwhelmed by all the changes occurring and, since the centralization was not delivering the expected results, they decided to switch back to a more mixed structure. Since all of this happened in one year time, they could only discuss this change in organizational model on a qualitative basis while no real quantitative data could be provided. This is the reason why this thesis will only address a quantitative approach for Rexel Netherlands but a qualitative approach for both Australia and the Netherlands. This is also why it has been mentioned in the limitations and extensions section (see 1.3) that a quantitative analysis from this Rexel Australia case could have led to further conclusions.

2.2.5 Data collection and analysis

Out of the six qualitative interviews carried for this case analysis, five were made with Rexel Netherlands and one with Rexel Australia as the core of this work is based on the Netherlands' case, which explains why most of the interviews were done with the Dutch employees. The main reason for this is that Rexel Netherlands had started their centralization before Australia and had thus more data to offer and information to share. However, to nuance the findings it was assumed relevant to vary the information source and thus to interview other Rexel employees from another country. The reasoning behind this is that even if the scope of this work is still limited to the same company (Rexel), studying different countries still means

⁷ SKU stands for Stock Keeping Unit. A SKU refers to the most disaggregated level with regards to the inventory. A SKU is supposed to be unique compared to other SKUs based on its characteristics (brand, color, size...).

studying different types of market. Consequently, this would help to nuance the findings from the Netherlands employees which would allow to draw more realistic conclusions. Also, the employee interviewed in Australia had a good knowledge of the company which allowed to collect enough information, even in one interview. Among the people interviewed in the Netherlands, there was Nico Rodenburg, DC manager. He is in charge of running the unique and central warehouse at Bleijswijk in the Netherlands. There also was Rob Vandam, who is in charge of the inbound and of the inventory. He worked for Rexel since 1982. As he is responsible for the inventory reliability, he mainly helped in collecting the inventory results for the Netherlands' case. There also were Kim Meijs and Sander Hoorweg (manager), both in charge of the transport and the distribution. They monitor all the goods that leave the DC for the hubs. Logically, they helped in collecting all the relevant data about the distribution structure of Rexel in the Netherlands. Finally, there also was Frank Dijkstra who started to work for Rexel since the 1st of March 2015. He is responsible for the procurement and the availability of stock, mainly for the items kept at the DC in Bleiswijk. Thanks to his position, Mr Dijkstra helped in collecting all the data referring to the purchasing and the sales. On the other hand, the employee interviewed from Rexel Australia was Suzanne Sheeran. Mrs Sheeran used to be a demand planner before becoming the inventory manager. Thanks to her cross-disciplinary experience, she was able to give different results regarding different departments of Rexel Australia. Since English was not spoken by all the employees from Rexel Netherlands, the questionnaire has been written in both English and Dutch. This means that some interviews were carried in Dutch and some others in English. As every single interview was recorded, the transcript of it would be written (see Appendix 2), again either in English or Dutch. As each interview was targeting an employee from a different function and/or department, the answers collected were abundant, different and sometimes not perfectly clear. As a result, some interviewees were contacted again and asked to clarify some of their sayings to make sure there were no misunderstandings or to collect more details on some points. After that, the next crucial step was the transition from the interviews' results to the thesis' applied part writing. Miles & Huberman (1994) have described how the data analysis should be carried: first, a reduction of the data. Such reduction would help to select and simplify all the data collected during the interviews (in this case). Secondly, the way the data are presented should be cautiously handled. This means organizing the information in a way to be able to summarize it properly. Finally, conclusions and verifications should be formulated as a result of the data tests and comparisons. This thesis has therefore been done as follows: after each interview, the transcripts have been written and the key ideas highlighted. Once all the interviews were done and the key elements

listed, a comparison between all the interviews was made. All the information assumed relevant enough could then be selected, simplified and organized, according to Miles & Huberman's method (1994). The next step was the comparison between the literature review and the two cases was achieved. This follows what Van Campenhoudt & Quivy (2006) describe as the information analysis. It appeared that while some of the theoretical findings were confirmed by the Rexel cases, some other findings were disconfirmed. Furthermore, when some key elements were developed in the interviews but not in the literature review, further scientific papers were read to fill this gap and support these points from a theoretical point of view.

2.2.6 Conclusions and recommendations

After this comparison, all the main similarities and differences have been put forward to formulate a conclusion, recalling the main findings (see De Moerloose, 2015). This has been highlighted in the section 4.1.3, in order to help future managers to see when theory and practice meet or differ. Also, some new elements were brought to light during the case study which can also lead to further researchs (Van Campenhoudt & Quivy, 2006).

As the literature review, the Rexel case study and the research findings were written, some recommendations (see 4.2.1) and a critique (4.3) could be formulated based on all these results. These last two points referring and answering to the research question.

2.3 Theoretical frame

As developed in the limitations (see 1.3.1), the literature review is limited to the supply chain field. This means that the strategy, the inventory, the transport and distribution, the purchasing and the service level are the main variables developed all along this work. Consequently, other departments that could be linked to this topic such as finance or IT are beyond the scope of this thesis. However, such scope was extended to the human resource and the corporate social responsibility as they have been mentioned several times during the interviews. These aspects are thus considered as having a link strong enough with the supply chain and thus added to this work.

Also, the theoretical part of this thesis has been carried using two main databases: ScienceDirect and EmeraldInsight. While there exists plenty of other databases, these provided enough information to write a satisfying literature review. It is possible though that using other databases would have brought other findings and conclusions.

3 Analysis and results

3.1 Overall

This applied part will analyse the French company Rexel which is spread worldwide, following the work done in the literature review (see 2.1). However, only results will be given in this chapter. The comparison with the literature findings will be discussed in the chapter 4. More specifically, two cases will be studied here thanks to the interviews carried (see 2.2 and Appendix 3): the case of Rexel in the Netherlands and the case of Rexel in Australia.

3.2 Rexel case: the company description

Rexel is a French group founded in 1967. It operates in 38 countries with 2,200 branches, a distribution network of more than 40 banners and 30,000 employees. Rexel provides innovative electrical solutions and equipment. The customers are electricians and SME contractors, key and international key accounts customers, large projects customers, government agencies and service companies and wholesale and retail resellers. Many suppliers of Rexel Group are global entities and can be found in different countries.

In the past, Rexel's structure used to be mostly decentralized and the reason behind this is the company's working method: acquisitions. The company often buys out and takes over other businesses to grow in a country and gain in market share. As a result, Rexel ends up with different decentralized warehouses and branches. Lately, the trend was towards centralization by merging all these decentralized entities previously owned by other companies. This confirms Weiskott (1998) and Wanke & Zinn (2004) findings who explained that high density products such as electronic components suit perfectly for a centralized system.

The Figure 4 below (see Derycke 2014) shows the different organizational models used by Rexel. The "Stand Alone" model which represents the decentralized structure, the "Hub & Spokes" model where there is now a Hub or a master Branch in between in addition to the "Stand Alone" and finally there is the "Distribution Center" (DC) which represents the fully centralized model. This last model is the one that Rexel has mainly been focusing on over the last years.

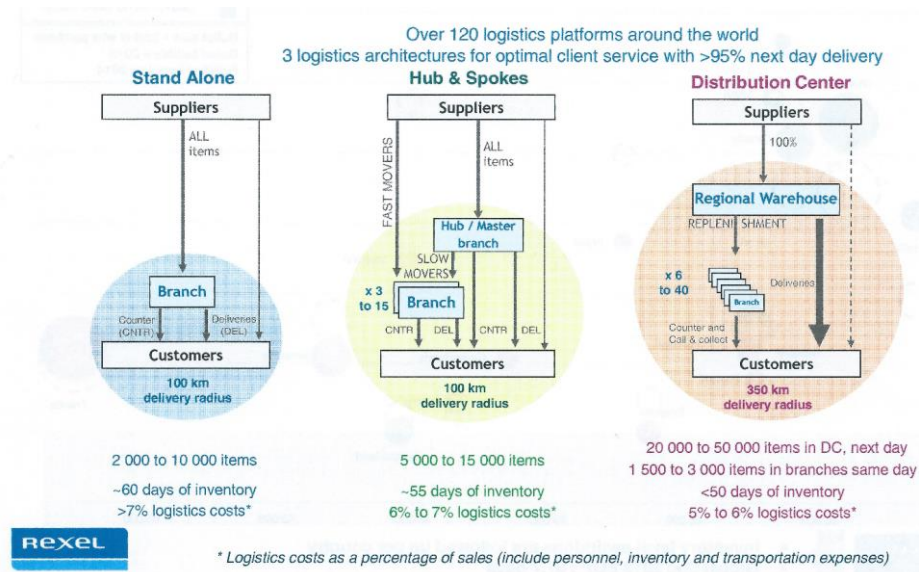


Figure 4

Rexel worldwide logistics organizational models (source: X. Derycke 2014)

The Figure 5 below (see X. Derycke 2014) shows how Rexel currently uses these models worldwide.

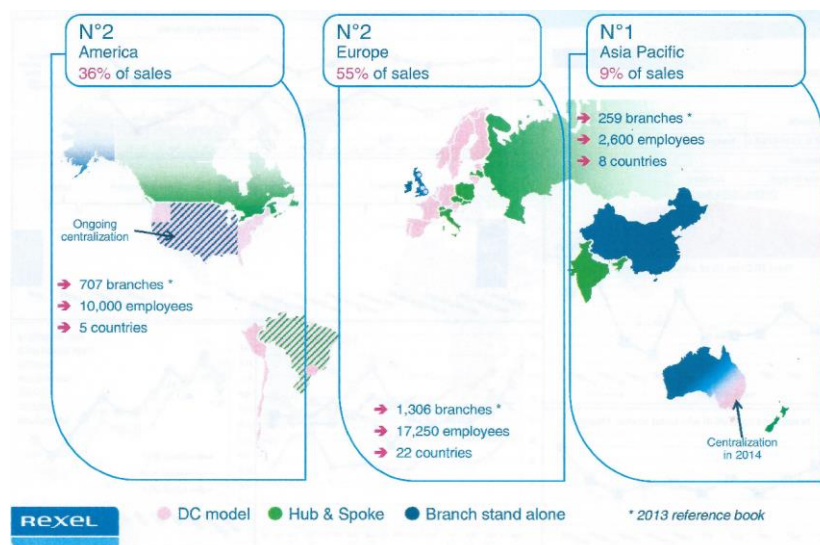


Figure 5

Rexel logistics centralization: the developed model (source: X. Derycke 2014)

In order to know when centralization would be relevant or should be considered, Rexel Group designed an assessment method, supposed to help the decision maker (see Appendix 4). Rexel Netherlands

3.3 Rexel Netherlands

This section develops the case of Rexel in the Netherlands. In this country, the company successfully managed to switch from a decentralized organization to a fully centralized one in a couple of years. The following describes this evolution of the centralized structure under different aspects, giving qualitative and quantitative results to demonstrate the efficiency of centralization.

3.3.1 Strategy

From five warehouses to one central DC.

The first decisions to centralize the different warehouses of Rexel in the Netherlands appeared in 2012 and 2013. The current result of this is a central and unique DC, in Bleijswijk. However, until 2010, Rexel had five different distribution centers across the country: one in Venlo, one in Den Bosch, one in Deventer, one in Bergschenhoek and one in Almere. Except for the DC in Almere, the other four used to belong to Hagemeyer before being acquired by Rexel. It is only from 2010 that each facility was rebranded under the logo of Rexel. Once Rexel finished its different acquisitions nationwide, it was decided to centralize all the facilities into one, mainly for cost reductions purposes, to reach a better market position and to offer a better service to its end-customers. Consequently, in 2011, the warehouse from Venlo and Den Bosch were closed and integrated to the one in Bergschenhoek. In 2012 Rexel opened Bleijswijk and moved Bergschenhoek there. At the end of 2012, Deventer was closed and merged with Bleiswijk. Finally, in the half of 2013, Almere was also integrated to Bleijswijk. Today, most of the issues resulting from the centralization have been solved and the employees are generally happy of the results. The latest major difficult step was, in 2014, to have only one VMS⁸ and one ERP⁹ system instead of the many different ones Rexel used to have in the Netherlands (see system below, 3.3.6, where this system problem is tackled). The managers are now trying to optimize different parts of the business but it is mainly trivial and on a low scale. For instance, a team is currently trying to improve the equipment used by the pickers to make it more user friendly.

⁸ VMS stands for Vendor Management System. Such system is a Web-based application that allows a company to monitor its staffing activities and services more easily.

⁹ ERP stands for Enterprise Resource Planning. Such system is a business process management software that allows a company to manage its business activities and automate back office functions.

The impact of this centralization and the merger of the different warehouses into one can be illustrated by the warehouse productivity. The Figure 6 below shows the evolution in productivity over the last years:

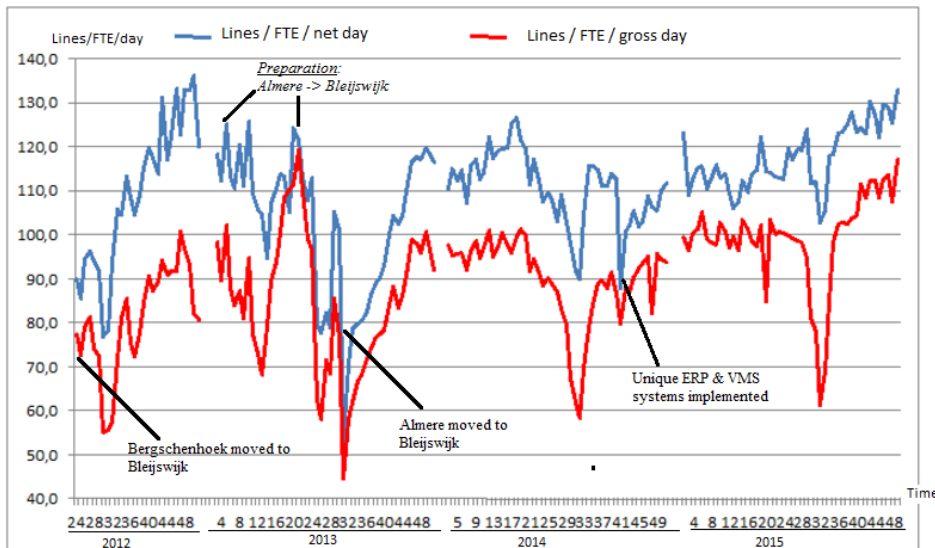


Figure 6

Rexel Netherlands warehouse productivity (in lines/FTE/day), from 2012 to 2015 (source: Rexel Netherlands)

On this Figure 6 we can see that the productivity's unit used in the warehouse is expressed in "Lines/FTE¹⁰/day" over the years. This means the amount of lines treated by a full-time equivalent employee in one day. A line is Rexel's unit of measure for the products handled during the business activities (see 3.3.4, purchasing and sales, for more details about the line system). The blue line represents the productivity per net day, meaning the number of lines treated by all the TFE present that day on the work floor while the red line describes the trend for the gross day, meaning all the lines treated by all the TFE in the payroll. On the Figure 6, three main drops can be observed: one in 2013 which represents all the changes resulting from moving Almere's activities to Bleiswijk. One other drop in 2014 that represents the switch to only one ERP and VMS system which took time and efforts. In 2015, the productivity was in average around 118 and around 128 at the end of the year. The drop we observe is on the red line so not that significant. All of this shows that even if the productivity was not always at its peak during the centralization process, it kept getting better and better. Indeed, the productivity as already reached back the highest performance from the past and the trend is expected to keep growing. The objective is to reach 142 lines per TFE per NET day by 2016.

¹⁰ FTE stands for "full-time equivalent".

Warehouse daily key performance indicators

To be sure this centralized structure remains, the managers at the DC in Bleiswijk have daily key performance indicators (KPIs) with daily objectives. These KPI's rely on five different levels: delivery, people, quality, cost and safety. Regarding the delivery, the objective is to get the products to the final destination at the right place on time with the right items and the right quantities, they call this "on time in full" (see 3.3.5, Table 11). About the people indicator, the managers follow how many people are present and absent and follow how many people are on holiday or sick (see 3.3.7, Table 12). The aim here is to keep the number of people absent from work as low as possible. Regarding the quality matter, they distinct the inner and outer quality. The inner quality is about the mistakes made by the employees in the DC and the incomplete orders treated. The outer one is about the number of customers' complaints and the mistakes made by the hubs. The costs are about the productivity of the warehouse: how many orders have been realized at the inbound and outbound levels of the warehouse (see Figure 6). Finally the safety is about all the injuries that happened to the employees with the objective to keep it non-existent. All these indicators are displayed on the board of each team leader, showing if the daily objectives have been met or not. While in early 2015 some results were still in the red, the end of the year appears to be good as most of the expectations are now fulfilled.

An advanced and competitive market

In addition to the costs reduction, an important reason why Rexel decided to go for centralization is the competitiveness of the market in the Netherlands. Indeed, an employee from Rexel Netherlands believes that having a decentralized structure is not a viable system since some costs would increase such as the holding costs due to higher inventory value, lowering the company's competitiveness compared to all the other competitors. They thus think that only a centralized system is possible. One reason for this tough competition is that in the Netherlands, there exists public databases offered by some companies which provides all the information related to different products. This way, the customers can check which company in the Netherlands sells the item A or B and at which price. Comparisons are therefore really easy to make between the competitors from a same industry, which put a lot of pressure on the costs. Such databases can even let the customers know if it would not rather be better for them to order in Germany or Belgium at a lower cost, despite higher distribution costs. Consequently, Rexel needs to be competitive by keeping its costs as low as possible to attract its customers.

To illustrate the above, an employee from Rexel described the Netherlands as an advanced market which is like 10 years ahead compared to other markets as the UK and Australia

regarding the way they work. To illustrate his arguments, the employee mentioned the “cultural” background. For instance, the branches that Rexel acquired in the UK and in Australia used to be family owned before. As a result, the mentality and mindset at these branches has always been “we do it ourselves” and very independent. Making them comply with a central DC where most of the decisions are taken is therefore not always easy to do (see Australia’s case about the lack of compliance issue, 3.4.3). In the Netherlands on the other hand, such cultural issue is by far behind for many years now. Almost all the employees in the Netherlands recognize the advantage of having a central warehouse and therefore agree to fully co-operate.

Another example to show why the Netherlands is an advanced market: the country is really pushing forward regarding the internet consumption behaviour. For instance, tax invoices are no longer sent by post but by e-mails. Even if this might be problematic for older people, this illustrates people’s attitude towards the technologies in general. This also explains the wish of Rexel Netherlands to switch to a more digital-oriented structure. To be e-business-oriented is good for the company as it allows to have all the data more easily put in the system and therefore better computations and better analyses can be made out of it. Being more automated also allows to reduce the labour costs as less human workforce is needed which is nice since those costs are, according to an employee of Rexel, *“by far the most costly part of doing business here in the Netherlands”*.

3.3.2 Inventory

Structure

As mentioned above, at Rexel Netherlands the inventory is centralized in a unique warehouse, at Bleijswijk. This distribution centre is in charge of delivering the goods ordered by the clients to seven different hubs, located at different key areas in the country. To reach the hubs, the carriers have to take some pre-defined roads from the DC. These hubs are responsible intermediary points, covering the demand of the end-customers from their area. This option appeared less costly than shipping the products directly from the suppliers to the end-customers or from the DC to the customers. There used to be more than seven hubs but in 2013, all were closed except the seven of today for costs, efficiency and logistical reasons. Since this seven-hubs structure is working well, there is no plan to reduce it in the coming years. Once the products arrived at the hubs, they are then dispatched to different branches, again, using specific roads from the hubs. These roads have been carefully designed and planned to optimize the ride

of the drivers. Once the products are stored in the shops, they can then be sold. These branches generally carry a very small inventory. Having a small stock of items at the branch can be seen as a safety net since, in the case of a disruption (for instance there is high traffic on the road or the trucks are stuck or broken down), the branch will still be able to deliver some products to the end-customers and make sales. This inventory is however only made of fast-moving items (F). Such inventory is automatically replenished following a minimum and maximum system. This means that for each item carried by the branch, a minimum and a maximum quantities have been decided. Once the quantity for a specific item hits the minimum level, a signal is automatically sent to the DC which then will deliver the next day this item to reach back the maximum level. Since the DC can easily and quickly ship products to the branches (within one day), it would be too costly and not efficient for the branches to carry more than the fast-moving items.

Generally speaking, when a customer enters the store, three scenarios can happen. Either the customer will buy from the limited stock if the product is available at the branch and pay for it. Or he will place an order that will be sent to the DC. The DC will then ship the products to the branch the next day so that the customers can have it. Or the customer's order will be directly sent to the supplier and a direct sale will occur. This last option does not require the utilization of the DC and is therefore not taken in account in their activities and forecasts.

Reduction in inventory value

At Rexel Netherlands, the facts demonstrate the efficiency of having a centralized inventory. The Table 8 below highlight the decrease in inventory since 2011 until now.

Table 8

Rexel Netherlands' inventory value evolution from 2011 to 2015 (source: Rexel Netherlands)

	2011	2012	2013	2014	2015
Stock value (in december)	€ 35.019.822	€ 29.190.619	€ 27.532.025	€ 27.363.913	€ 27.416.988

A clear reduction of € 7.602.834 in the inventory value can be observed thanks to this centralization since 2011 (when there still was no unique central DC). This demonstrates the impact of the risk pooling effect and the square root law described in the theory (see 2.1.3). The inventory value however decreased to a higher extent than what the literature says, 21,7% instead of 14% (see 2.1.3 and Wanke & Saliby's finding (2009)). This thus confirms that being decentralized increases the inventory value since all the branches have to carry extra safety and

cycle stocks. But also, in the absence of a centralized DC, the total delivery times from the supplier to the branch are increased (see 3.3.3, transport and distribution). Instead of receiving the products after one day at the branch as in the current centralized structure, the products will rather take two weeks once an order is placed which will again raise the safety stocks' needs and consequently the inventory value.

Positive externalities

As they were interviewed, the employees from Rexel mentioned positive externalities on the business resulting from having an inventory at a unique centralized place besides the value reduction. Indeed, having everything pooled at a unique facility also allowed an increase in the inventory reliability (see the sub-section below about reliable inventory) and an increase in service level (see the part service level below at section 3.3.5). An additional strength of a centralized system, put forward by an employee, was the lifting effect of centralization. Such effect is hard to quantify in terms of increased sales but the employee said that having a centralized inventory enables the company to have a good products turnover at the branches. This means that if a customer enters the branch and sees this item is selling well, such customer might be tempted to keep buying from Rexel as he knows the company has good stocks for it and will have it available. This visual attractiveness can thus increase sales.

Inventory KPI

Some of the main KPIs from Rexel Netherlands at the DC level are inventory related. Such KPIs are keeping the total inventory value as low as possible and defining the products from the assortment that should be kept at the warehouse instead of on order from the suppliers.

Rexel tries to always have enough fast-mover items (F) in stock in order to guarantee a service level of 99% and of 95% for the medium mover items (M), meaning these items will be less kept in stock than the F ones. Finally, the slow mover items (R) are never kept in stock. These last ones are always obtained on order. This means that the company decided that only F and M items deserved to be stocked at the DC. The R items are too costly to stock since not frequently enough sold. As a result, these items are only bought from the suppliers when a customer makes an order for them. The Table 9 below illustrates the above:

Table 9

The frequency classes classifications (source: Rexel Netherlands)

Frequency class	F1	F2	M1	M2	M3	R1	R2	R3
Description	"Frequent/Fast"		"Medium"			"Rare"		
Number of orders	520 - ∞	121 - 519	83 - 120	41 - 82	14 - 40	6 - 13	1 - 5	0
Item stocked	Yes	Yes	Yes	Yes	Yes	No	No	No
Stock shipment	Stock	Stock	Stock	Stock	Stock	Order	Order	Order

Reliable inventory

However, determining which items deserve to be considered as from the F, M or R class requires an efficient and reliable database. When everything has been centralized, one of the main and important mission for the people responsible of the inventory was to reinforce the relevance and reliability of the data. As a result, every item had to be checked and counted to make sure that all the products were at the right place with the right quantity. In 2013, the reliability of the inventory was about 68%. This means that up to 32% of the products could not be found at the right place. This was an issue because it was delaying the picking process since the pickers could not directly find the item they were looking for. Or even worse, wrong items could be shipped to the customers as a result of this low-reliability inventory. Today, this accuracy has been raised to 90%, highlighting the efficiency of this centralization. The reason of it has been keeping the warehouses cleaner and with a better arrangement. Also, some devices have been used to make sure the products do not slip away from their locations. In addition to all of this, a new rule has been set that every year every item's location should be reviewed at least once, to make sure everything is at the right location. Data accuracy is therefore key for a centralized system. In the section 3.4.4, regarding Rexel Australia's case, it is discussed how a lack of proper data can prevent the company from centralizing efficiently.

3.3.3 Transport and distribution

Geography

One main reason why Rexel Netherlands' structure is more efficient with a centralized system is that since the geographical area of the country is relatively small, the transport lead times can be quite short. As a result Rexel Netherlands has many suppliers delivering the products at the DC several times a week instead of only one time. This is favouring a pooled inventory in a

unique facility since this DC can often be resupplied and can also resupply the branches (see 3.3.2, inventory).

Structure

The current transport structure of Rexel is simple (see Appendix 6): one central DC, seven hubs and 17 branches (see Appendix 3). Since all the inventory is centralized at the DC in Bleiswijk, whenever an order is placed, the DC will ship the required products (except in the case of a direct shipment¹¹ or direct sale¹² to the customer) to the hubs which then will deliver the products to the branches or the end-customers.

The daily tasks of the employees in charge of the transport are to make sure that all the products are correctly delivered during the right time slots¹³. These time slots define the schedule of the carriers. Different times are agreed beforehand between the customers and the DC defining the time at which the carrier has to arrive at the DC, when he has to leave and when he should deliver to the customers or to the hubs. If something went wrong or if a delay occurred, the transport team will investigate to find the reasons behind this. It could for instance be a bad traffic or a mistake made by the driver. Thanks to their centralized system, it has now been made easy for Rexel to follow these carriers and check what times they arrived at the DC and at the final destination as a result of more reliable data (see 3.3.2, inventory) and better system utilization (see 3.3.6, system). This centralization thus helps to better monitor the performance of the deliveries. Also, Rexel designed different routes for the day and night deliveries. These routes must be followed by the carriers except in some specific situations (for instance bad traffic or impassable roads). Again, these routes have been carefully chosen and believed by Rexel to be the most efficient ones.

Another way Rexel benefited from the centralization on the transport level is that the deliveries are now more efficient. This is explained by the fact that in addition to having more reliable and quicker deliveries, the trucks are now most of the time full when they leave the DC for the hubs, what previously happened to a much lower extent.

Improved delivery time

Another transport improvement resulting from this centralization is the delivery time. Previously, as there were five different DC's, the inventory was split among them. It could

¹¹ The product is directly delivered from the supplier to the end customer.

¹² The product is directly delivered from the branch to the customer thanks to the small stock it carries.

¹³ Time constraints within which the carriers have to pick and deliver the product from a point A to a point B.

therefore happen that an order from the customer could not be served by only one warehouse since the products were at different places. As a result, different DC's had to pool their inventory together to fulfil the order. This was costly in two ways: firstly, in time. An employee was in charge of combining the different products for the order. He therefore had to manage the different DC's involved to obtain the right products and the right quantities before shipping everything to the hubs. Secondly, this was also costly in terms of money. Since a part of the work force had to be seized for this order pooling task, it means the employee could not work on other activities which thus causes extra labour costs. In addition to this, having to merge stocks from different warehouses could increase the risk of making mistakes (for instance wrong quantities or wrong products). Centralizing the inventory made Rexel able to remove this risky matter. As a result of the above, the deliveries are now quicker thanks to the centralized system. Indeed, there is no more need to merge the products from different DC's for a same order. The delivery is thus faster, cheaper and more reliable as there are potentially less mistakes made.

In general, when a customer places an order today, he will receive it by the next day. This is the so called day plus one (D+1) promise from Rexel to its customers. However, if a customer urgently needs a product, it can be delivered the same day. In this case, an express carrier will be hired for this kind of urgent situation and directly deliver the client, without going through the hubs structure. Or, the customer can come and pick himself his products at the DC or at a branch if this solution suits him better.

Disruptions

Regarding the disruptions taking place during the transport, these are quite rare. It can happen that a truck breaks down or that there is an accident but generally no serious problems are mentioned. The transport team tries to anticipate as much as possible and to always keep the customer aware of the deliveries state. Also, since Rexel sends some of the carriers at night time, the chances of being stuck in the traffic is reduced as there are less people on the road.

Cost reduction

Overall, the distribution costs considerably decreased after the centralization. Indeed, the number of drivers and trucks needed got reduced since the products were not leaving to the hubs from five DC's but only from one. In the beginning of 2009, Rexel had 21 carriers (including their own drivers) delivering the products from 17 different locations in the Netherlands. In 2012, the centralization process has begun and the company only had seven carriers left (including their own drivers), with only eight hubs left. From mid-2012, all the

carriers used by Rexel were outsourced and there was only one carrier left for the south part of the country. Currently, the company only has three carriers for the day distribution and one partner for the night transport (from the DC to the hubs).

The Table 10 below summarizes the distribution costs (in millions of euros) from Rexel Netherlands over the last years. The box “rest” means the costs related to the carriers, their salaries and the diesel. We can see that since the centralization process began in 2012, these total costs decreased by around 24% in three years, saving two million euros to the company until now.

Table 10

Rexel Netherlands’ distribution costs evolution from 2012 to 2015, in millions of euros (source: Rexel Netherlands)

	2012	2013	2014	2015
Day Transport	1,5	1,4	1,2	1
Night Transport	5,5	5,3	5,1	4,8
Rest	1,4	1,2	1,1	0,6
Total	8,4	7,9	7,4	6,4

A cut in the number of drivers is completely cost-effective since it reduces the labour costs, but it also reduces some indirect costs such as other kind of disruptions than the ones mentioned above. For instance when the drivers are sick or on holiday and thus need to be replaced. Also, the drivers and the trucks are not from Rexel anymore and thus are all fully outsourced, for costs reasons. However, they drive with the logo Rexel on their trucks. Another reason why these distribution costs have been reduced is that Rexel Netherlands has around a hundred suppliers. As a result, it is more expensive to make the supplier deliver the products at five different locations than one. The centralization therefore cuts the delivery costs at different levels.

3.3.4 Purchasing and sales

Structure

Rexel’s purchasing structure is as follows: there is a distinction made between procurement and purchasing, each level having its own department. The purchasing team is centralized and is in charge of making the contracts with the suppliers. While on the other hand, the procurement team which is centralized at Bleijswijk’s DC is in charge of buying inside the contract limits decided by the purchasing team.

The products are normally all purchased by the central DC from the suppliers. The DC will then ship the goods to the different branches when required. A branch can therefore not order products directly from the supplier to keep it in its inventory to sell it to a customer later on (see 3.3.2, inventory). The only scenario where a branch is allowed to directly purchase an item from the supplier is for direct shipments to the customers. The central DC is thus in charge of all the products and sales flows except the ones that are linked to direct shipments made by the branch, from the supplier to the end-customer.

Increased bargaining power

Being centralized at the purchasing level can have advantages. Since all the purchases are now made from one point, this allows the company to buy in bigger quantities increasing the bargaining power towards the supplier. Since the company becomes a more important client to the supplier, the conditions can be better for the company. For instance, the supplier delivers the products more frequently like on a weekly basis. Rexel has even suppliers delivering the items up to three times a week, allowing the company to keep stocks low as it can order and receive them quickly after.

Thanks to this increased bargaining power, the company can thus allow itself to demand more from the suppliers. One of the objective of the firm is to change the packing of some products. The reason is when the pickers pick the items in the warehouse, they too often have to count piece by piece which wastes a lot of time as a result of a not efficient packaging. For example, when the picker has to pick 30 pieces of one item but the box is a box of 100 pieces, the picker has to count 30 times which is time consuming since he has to do it for many items on a daily basis. However, if an agreement can be found with the supplier to change the box quantity to match it with the general amount desired by the end-customer, this will result in a time saving.

Unfortunately, the company did not measure nor followed closely the gains in terms of price or discounts. Rexel knows this can add value to the business (see 2.1.6) as there is money to save thanks to the discounts and as their strategy should take this into account but this is not the priority of the company at the moment.

The lines system

Rexel works worldwide with a system of what the company calls “lines”. This means that when an item is sold, it will be expressed in terms of line. One line equal the number of times a product has been sold for a customer. For instance, if a customer buys 100 pieces of the item A in September, the company would have sold one line of A that month. While if 10 customers

buy 10 pieces of the item A the same month, this line would have been hit 10 times. This is also the way Rexel decides if a product is a fast moving one or not, depending on the number of time a line is hit per month and on the whole year (see Table 9 of the different items classes at section 3.3.2, inventory).

However, this line system can be tricky and this can be shown through the above example. When only one customer buys 100 pieces of product A each month, this results in only one line of this item A being hit that month. This would definitely make it a slow mover item. However, if 100 customers buy one piece of A, this will make this item A a medium mover item and no longer a slow mover one. As the Table 9 in 3.3.2 (inventory) shows, the slow mover items are only on order, in opposition to the medium and fast mover ones which are in stock.

Consequently, the pros of this line system are an increased risk repartition and management. If the item is considered as slow mover since it is only sold once a month, it is really risky to stock it if the customer appears to stop buying it all of a sudden. The company would then potentially have 100 pieces of agonizing¹⁴ stock if it cannot find any other buyer for this item in the coming weeks. While if there are 100 customers, the risk is much smaller since if one customer stops buying, there are still 99 left that will be purchased which only causes one piece of the item A to be potentially agonizing. Also, a Rexel's employee believes that in a decentralized system, such structure ends up having even more agonizing stocks as it has to carry more cycle and safety stocks in total.

On the other hand, the cons of such line system are losing important customers buying specific products. Indeed, if the company has only one customer buying in large quantities a product that no other customer buys, the item will certainly be considered as a slow mover. Therefore, the product will not be in stock when the customer will order it. As a result, even if the procurement team knows perfectly well that this customer orders once every month 100 pieces of the item, it cannot put the item in stock. This can be annoying for the customer which might therefore look for another company which has the item in stock and thus will ship him the item more quickly.

To fix this issue, Rexel Netherlands is not fully following this line system rule and adapted its forecasting system to the frequency of an item's sales. It is potentially riskier since as mentioned above, if the only customer for an item stops buying, the company will potentially have agonizing stock. But the Dutch team justifies this by saying that thanks to their modified

¹⁴ At Rexel Netherlands, an "agonizing" stock is a stock that has not been sold over the last 12 months.

forecasting system, they manage to sell their products every month and they have a nice product turnover. This results in having happier customers who will potentially buy more.

Such line system is thus favouring a centralization since by piling up the demand for an item, the different levels of “historical demand pattern¹⁵” for this item are aggregated, making it easier for the procurement to predict the future sales of this item. This will potentially move the slow mover (R) items into medium movers (M) ones, allowing these products to be stocked for the customers. While in a decentralized system, some items would not be fast moving enough to be stocked and consequently, lost sales could happen. A centralized system therefore reduces the drawbacks of Rexel’s line system. The customers will potentially be better served in a centralized system since items are more in stock and the products are easier to predict.

3.3.5 Service level

The service level is considered as a really important variable to follow and measure. Rexel’s worldwide policy is indeed to be close to its customers. That has been recalled during the interview, when the employees underlined the importance of having a proper availability to customers.

During the interview, Rexel’s employees said that they did not observe a decrease in service level to their end-customers resulting from the centralization. Indeed, as they kept the same hubs structure they had in the decentralized system, their location from the end-customers remained unchanged. Rexel thus did not get closer or further from its end-customers after the switch to the centralized system.

The Table 11 below shows the evolution of Rexel Netherlands’ service level over the last years.

¹⁵ A historical demand pattern of an item is the sales ‘behavior for this item. This means, how was the item sold in the past. Knowing the historical demand pattern of an item helps the procurement team to make more accurate sales forecast of such item.

Table 11

Rexel Netherlands' service level evolution in terms of transport, from 2012 to 2015 (source: Rexel Netherlands)

(months)	2012	2013- Q1	2013- Q2	2013- Q3	2013- Q4	2014- Q1	14-Q2	14-Q3	14-Q4	15-Q1	15-4	15-5	15-6
Not delivered	1,2%	1,2%	1,1%	1,6%	1,2%	0,9%	1,0%	1,1%	1,9%	1,2%	1,9%	2,2%	1,7%
Exceeded timeslot	13,0%	7,7%	9,2%	12,9%	7,3%	2,5%	3,4%	3,7%	4,5%	2,5%	2,5%	5,3%	3,8%

This Table 11 shows that even if the company kept the same distances from its customers after the centralization, an increase in service level can however be noticed at the transport level. Indeed, while the time slots used to be exceeded in 13% of the cases in 2012, this decreased to 2,5% at the same time of the year in 2015.

Longer opening hours

Another positive consequence from this centralization regarding the service level is that the opening hours from the DC have risen. Previously, the five different DC's at Rexel Netherlands were open until 5.30 PM. Now, the centralized DC is open until 9 PM. The reason for that is thanks to this centralization, Rexel started to have a night shift at the DC. As a result, the day shift kept working the same way as previously, but the new night shift was able to treat later the orders coming from the branches. In the past, customers placing orders after 5.30 PM could generally not receive their products the next day while thanks to this centralization they now can. There is thus now a pick processing team working in the day from 10 AM to 7 PM and a night shift, working from 12 PM to 9 PM.

Increased product assortment

Also, thanks to this centralization, the product assortment available at the warehouse is broader than the assortment available in the former decentralized DCs in 2012. The reason for it is that having a broader assortment means more products in stock which can be really costly to achieve in the case of a decentralized system at the inventory value level because of the holding costs¹⁶. The products portfolio at each DC was therefore limited. Now everything has been centralized,

¹⁶ For Rexel Netherlands, these holding costs are up to 24% of the items' value.

it was made possible for Rexel to increase its product assortment while maintaining the overall inventory value low. The centralized system is thus more in line with one of Rexel's main objectives which is to be close to the customers and offering them a service of quality.

Complaints reduction

The effectiveness of the centralization for the service level can also be illustrated by a reduction in the number of complaints from the customers. During the decentralized period, the deliveries reliability was bad, and thus not satisfying the customers. One of the reasons for this is the absence of a unique ERP and VMS system (see section 3.3.6, system). Now the deliveries' reliability is improved, the amount of complaints notably decreased.

Being centralized also helped the customers in terms of facility. In the past, as there were different warehouses, this could be confusing or annoying for the customer. As this customer placed an order, it could appear that the items he asked for were not directly found and/or at different DC's. The consequence of this was a waste in time for both parties since the products had to be first localized, then combined before being shipped to this customer. This has been mentioned several times by the customers as an issue. That is why Rexel tried hard to fix this issue. After the centralization, as there was only one facility open, it was much easier for the customers to know where to place his order. As a result, the waste of time disappeared and the number of complaints decreased.

3.3.6 System

From two to one

Rexel Netherlands is currently using one ERP system (M3) and one WMS system (Astro). However, this has not always been the case. In the past, while the company was still decentralized in the country thus having different warehouses at different locations, different systems were used. This comes from the fact that these different warehouses were the result of different company acquisitions made by Rexel in the past. Consequently, each former company had initially its own ERP and VMS system. Once they got bought by Rexel, a harmony had to be found. Furthermore, having only one ERP system at the DC helped not only the teams at the central warehouse but also other departments such as finance, sales and the reporting by having clearer and more reliable databases. The company could also use more easily Slim4 which is an add-on tool that is linked to the ERP system. User friendly, this add-on gathers data in Excel which allows easier data computations, comparisons and analyses.

Reliable data

When different systems were being used, the data was made complicated to monitor. This was impacting negatively the activities of the company. For instance, at the inventory level: the stock had to be searched in different databases since the company did not know exactly where the products were. As a result the stock could not be delivered on time, or not with the right products or not at all. Also, this impacted the transport: the deliveries and the drivers could not be easily tracked and mistakes were therefore occurring. The performances of the carriers could for instance not be relevantly analysed. However, when the company switched to a single ERP and VMS system, many improvements could be observed regarding the data monitoring and better analyses could be made. Indeed, the company could now easily export its databases to Excel to make computations and draw conclusions. This better visibility and transparency of the data allowed the company to have a better stock reliability and to improve the performances of its transport. Indeed, thanks to the system, the performances of the carriers can now be followed and do not have to be based on feedbacks of the customers or the drivers themselves anymore. This is convenient since there sometimes were arguments and it was not easy to find which party (between the customer and the carrier) was right or saying the truth. All of this led to an improved service level (see 3.3.5, service level).

The improvements made thanks to the system is an illustration of what Rexel Netherlands currently tries to achieve: to develop its digital technology and infrastructure. The company plans to get rid of all the paperwork and to switch to a fully digital management. It believes it will help Rexel to better collect and analyse the data. The firm therefore started to automate its activities as much as possible and this started since 2013.

Risk diversification effect

The advantage of the risk diversification (see 2.1.4) effect has been mentioned by Rexel employees. They said that a disruption, especially occurring at a system level, can be highly problematic as it would block the operations from the DC. Logically, considering the case of a centralized system with a unique facility and a unique system, all the business would then be shut down if the system had to be disrupted. On the other hand, in the case of a decentralized system, the company would still be able to deliver the products to its clients, thanks to its other DC's that still have their systems running. However, it appears that more disruptions occurred in the decentralized scenario. When asked about it, Rexel's employees said that one kind of problem they frequently had was "the inventory difference". This means when the products are not where they are supposed to be even if the system says so. There are many reasons to this

problem, referring to different disruptions: for instance the products were wrongly received at the inbound area, not scanned properly, put at the wrong location or the picker had picked the wrong item. The number of disruptions observed has drastically decreased when the company switched from a decentralized to a centralized system. To illustrate this, in the decentralized situation, the company used to have two full time employees working on these disruptions every day to find the causes while now, it only takes two hours. This shows how the disruptions were more of an issue during the decentralization. Besides that, not a single disruption related to centralization has been mentioned by the employees as being frequent or problematic. For instance, no problematic disruption could be mentioned at the transport level.

Too much centralization

However, centralization can have limits. The following illustrates this. Rexel decided to merge the databases from Rexel Netherlands and Rexel UK (in the United Kingdom) as they use the same VMS system. Both countries thus now share the same information. This means that the Netherlands depend on the UK regarding the support. But this can lead to issues. For instance, when Rexel Netherlands decides to make some purchases or increase its inventory for a reason X or Y as it is advantageous for its market, this can impact the UK as their market is different but the databases are linked and therefore impacted. This is maybe not the best solution since both markets are really different and the way of making business too. In the Netherlands, many sales come from E-business while the UK rely more on calling and the faxing machines. Last time, the whole procurement team from Rexel Netherlands was unable to work during two hours as an error linked to this shared database occurred in the UK.

3.3.7 Human resources

Workforce reduction

Following what has been discussed in the theory (see 2.1.7) and thus as expected, a consequence from this centralization has been a decrease in terms of employees. Indeed, since there was five DC's during the decentralized organization and different teams running them, different people used to occupy the same function at different locations. For instance, there were people assigned to the inventory control at each warehouse. More carriers were also required as the goods were leaving from five DC's instead of one for the hubs. In the beginning there were different purchasing teams. All of this was costly for the company. Centralization appeared to be a smart move since costs decreased in terms of labour costs and workforce but also at the inventory and transport levels. This decrease in terms of human resources (see Figure 7) can be illustrated by

a switch from more or less 160 employees (full time and temporary full-time ones) to 100, in other words a reduction of around 37,5% in the work force has been executed. For the future, the company plans to keep reducing its need in employees by more automating every processes of the chain (see 3.3.6, system). However, such staff reduction was not easy to handle at first. Indeed, in the case of Rexel Netherlands, after the reduction in the work force, many employees were complaining about the amount of work to do while having less people. Thanks to having managers who followed their employees and gave them a good training with the system, the company managed to reduce the amount of complaints from its employees and have everything run smoothly again. For Rexel, after a few weeks all the work was done again, but with less people.

The following Figure 7 highlights this work force reduction with the full time employees in blue and the temporary full time employees (interim ones) in red:

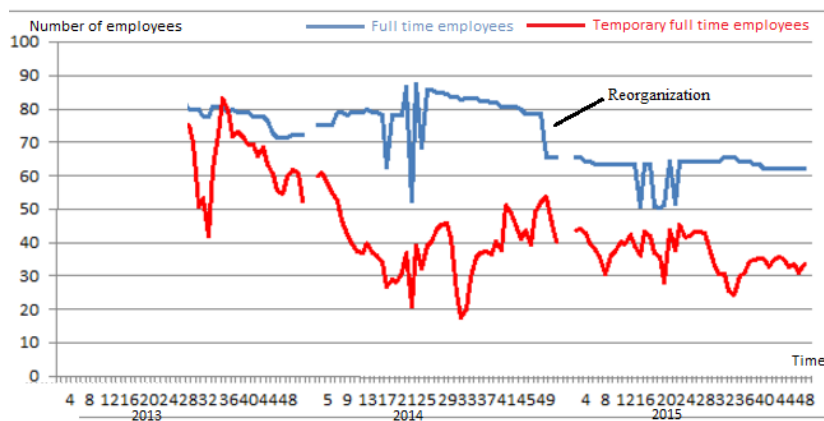


Figure 7

Rexel Netherlands' workforce evolution, from 2012 to 2015 (source: Rexel Netherlands)

The evolution of this work force is the result of the fusion of the different warehouses into a single one. At the end of 2014, an important decrease in the work force was achieved, due to a reorganization resulting from the centralization.

In addition to this and as mentioned in the KPI section (see 3.4.1, strategy), one of the performance indicator of Rexel Netherlands is to measure how many people are present at the warehouse and not on holiday or sick and to keep this number below 5%. If we have a look at the figures, we can see that while the number of people taking days-off has slightly increased after the centralization (from 13% in 2013 to 14% in 2015), the number of people being sick has decreased a lot (from 12% in 2013 to 6% in 2015). See Table 12 below.

Table 12

Rexel Netherlands' workforce state evolution from 2013 to 2015 (source: Rexel Netherlands)

Total	2013	2014	2015
Day-off	13%	12%	14%
Sick	12%	10%	6%

The reason of this strong decrease of sickness (from 12% to 6%) is mainly due to the fact that during the centralization changes, many people had to fix different issues on the field and were thus more exposed to bad conditions (risks of injuries or bad weather). As a result, once the centralization was fully achieved, the company focused on keeping the number of people sick and off work as low as possible.

3.3.8 Corporate social responsibility

CSR trend

Next to all the above, an important and key aspect of making business has not been developed yet: the Corporate Social Responsibility (CSR) of a company. The CSR is getting nowadays more and more attention (see 2.1.8). This indeed started to become a tool of attractiveness and competitiveness to a certain extent (Owazuaka & Obinna, 2014) as it can lead to win-win situations. Indeed, some people prefer to buy from or to work for a company which shows some gesture for the society rather than a company that does nothing at all or behaves negatively. As a result, many companies oriented their business to show their will to work not only to flourish their business but also to give something back to the society. Considering the CSR is therefore more and more important nowadays. Many people and NGOs like to, through the media and the Internet, denounce and accuse the companies whose behaviours are not enough “social-oriented”. Different CSR aspects of a company can be taken into account while looking at centralization and decentralization. Indeed, while each structure has its advantages and disadvantages in terms of costs, the reasoning can be deepened and tackle the social responsibilities while making business. The following will therefore show how centralization and CSR can be linked.

Environmentally friendly responsibilities

As mentioned above in the purchasing and sales section (see section 3.3.4), the centralization led to bigger quantities ordered at the supplier level which then led to an increase in the bargaining power for Rexel Netherlands. This increase can be profitable in many different ways for the company. The example of having different box quantities was given in the section 3.3.4,

explaining the waste of time Rexel Netherlands currently had with its pickers and the not efficient packaging of the products. This box quantity example can be used again, this time at the CSR level. During the interview, a manager from the DC of Bleijswijk explained that when the company receives the products, it happens that some items are packed in a box which is also packed in box and so on. There is no justification for having such packaging. Not only it is costly in terms of time since the pickers have to open each box to get the items but it is also costly for the supplier in terms of raw material and costly for the environment since those boxes are not all used properly. Consequently, changing these boxes and their quantities to match the real use that is made out of them would be advantageous. Not only for the company but also for the supplier and the environment, which could be seen as a win-win(-win) situation. This would make the company more environmentally friendly. This reminds what Owazuaka & Obinna (2014) said in their paper (see 2.1.8), developing that while doing CSR, a company might be tempted to convince its stakeholders to also achieve a more social and environmental attitude in their daily business activities in order to keep a good reputation. Other examples of CSR can be shown through this centralization.

The changes made at the transport level can also be linked to an improvement in terms of CSR. Indeed, as mentioned above in the transport and distribution section (see 3.3.3), a reduction in trucks and carriers has been made thanks to the centralization of the five warehouses into one. This meant a reduction in costs for the company but also meant positive externalities on the environment since less trucks are on the road, meaning less pollution. Furthermore, since less warehouses are open, the needs in energy and lighting are also decreased, favouring again a greener behaviour. This recalls what Owazuaka & Obinna (2014) mentioned in their paper, saying that one of the benefit from being involved in the CSR is a reduction in operating costs. This could indeed be achieved here and led to a reduction in the transport costs.

On the other hand, centralization does not only have positive sides towards the CSR. For instance, it has been developed above (see human resource section, 3.3.7) that the change in the organization system led to many people being fired (25% reduction) which is maybe not considered well socially responsible by everyone.

3.3.9 Case conclusions

None of the interviewees could mention any reason justifying going back to a decentralized system. They all believed that centralization is what suits them best, thus the best option. There is not a single aspect they could think of that would be better off in a decentralized structure.

The only thing that could potentially be improved would be the service level and be closer to the customers. However, seen its central DC, its hubs structure and its 17 branches covering the country, Rexel Netherlands sees at the moment no advantage of changing their current organization, even for the service level which is assumed good enough at the moment.

The facts indeed support centralization in the case of Rexel Netherlands. The inventory value and the distribution costs have decreased thanks to merging the five previous DC's into one. The service level has improved thanks to more reliable and quicker deliveries and a wider product assortment. Also, an improved bargaining power towards the supplier makes the company more able to demand more advantageous prices or contracts. This can help them for their future objectives such as the new packing Rexel Netherlands is looking for. Besides, being centralized is advantageous as it produces less administrative paperwork: for instance there are less orders, less items or lines to be received and less invoices which makes everything easier for the teams.

No big problem has been reported as a direct consequence of the centralization. Different issues had however to be tackled and solved but everything occurred smoothly. For instance, the work force had to be adapted to the central warehouse, some people had to move to the central DC in Bleiswijk while some others got fired. In 2014, the different ERP and VMS systems used previously were merged to only one which greatly helped the company to better monitor and to increase the reliability of the data. The branches now have to cooperate with the central warehouse while they were previously more independent. However this is not an issue since the context in the Netherlands is favourable seen the cooperative mindset.

The next centralization objectives for Rexel are to cut out a level in the vertical chain. For instance, the company could take over its manufacturer. This way, Rexel would be in more control of the costs and the margins would not be split among two parties. This way allows the company to have even lower prices and be more competitive. A summary of this Rexel Netherlands case is made in the following Table 13:

Table 13

Pros & cons of centralization at Rexel Netherlands

Pros of this centralization	Cons of this centralization
✓ High productivity ✓ Lower inventory value and costs ✓ Lower distribution costs ✓ Deliveries improvement ✓ Better bargaining power and better supplier deals ✓ Higher service level ✓ More reliable system and database ✓ Less workforce needed ✓ Potentially better CSR involvement	- No economies of scale - No real disadvantage observed nor measured

3.4 Rexel Australia

This next section will qualitatively compare some of the findings from the Rexel Netherlands' case with Rexel Australia in New South Wales. The aim is to illustrate that what is true for a market, might not entirely be for another one even inside the same company. However, no quantitative analysis will be made in this part as over the last two years many changes occurred which made the data collection difficult for the company in Australia.

3.4.1 Strategy

As mentioned in the company description (see 3.2), the old model from Rexel Australia used to be fully decentralized (the Stand Alone), where the branches directly ordered from the suppliers. Around two or three years ago, the company decided to switch to the distribution centre organization and to become fully centralized.

When asked what were the main advantages and disadvantages from this new centralized model, the employees said that their freight costs were reduced as they did not have to ship to different locations but only to one. Also, their buying power towards the supplier was increased. However, being centralized prevented the branches from being independent and autonomous and decreased the service level.

After more or less one year of being centralized, the company decided to review its model and to go back to a more mixed-structure, as depicted in 2.1.5 about a mixed or partially centralized inventory system. A “happy medium” is thus what the company is currently looking for. This can be linked to the “golden mean” described by Cummings (1995) in the literature review. The

main reason for not staying centralized is the lack of compliance from the branches (see purchasing and sales below, section 3.4.5) which did not buy from the DC but rather directly from the supplier. The company knew that branches might not fully comply but not with such a big extent. The problem was thus bigger than foreseen. Another reason why the centralized model did not work is that the company did the centralization process within a really small timeframe. In only one year, the company went from around three thousand SKUs to more than 20 thousand parts. That was too quick and thus led to some inventory and logistical problems which are now pushing the company back to a more decentralized structure, between the Stand Alone and the Center Organization models (see 3.2).

3.4.2 Inventory

In the past, when Rexel Australia was more decentralized, the branches had more autonomy and could deal directly with the supplier and did not need to go to a middle-man as in the case of a centralization. Each branch acted on its own which led to issues especially at the provisions and safety stocks levels. Indeed, if each branch works independently, this generates much more provisions than needed. Consequently, some products will end up being overstocked and this issue is multiplied by the number of branches the company has. This considerably increases the inventory value, thus the holding costs. That is one of the reason why Rexel Australia tried to centralize its inventory in a central DC for New South Wales. Because of the lack of compliance from the branches, this centralization did not work as expected and the company had to decentralize again its inventory. While the centralization process made the company stock around 20.000 SKUs in the central DC, the company is now going back to the previous replenishment model, knowing around 3000 to 4000 SKUs. This decision was cost-related.

3.4.3 Transport and distribution

Overall, for Rexel Australia, the distribution costs were reduced during the centralization as the company did not have to ship to different locations anymore but only to one, the central DC. However, since the overall strategy changed and is now aiming for a partially centralized structure, things are moving again. While last year, the company was increasing its number of suppliers as it was centralizing everything at one place, now it is doing the opposite and reduces its number of suppliers. The distribution costs will therefore be affected.

3.4.4 Purchasing and sales

Thanks to the centralization with the new DC in New South Wales, the buying power towards the suppliers of that area had increased as the company was now bulk-buying. Furthermore, buying in bulks in one big order instead of small shipping many times as in a decentralized system helped the company to make more savings. These savings could be made in terms of purchasing as the company could get better prices. The savings could also be in terms of handling costs since it was easier for the company to receive and put away the goods in the locations as they arrived in pallets instead of multiple small boxes.

The objective of the centralization was simple: the DC would place the orders at the suppliers and gather all the products at this single location. Then, when a branch would need specific products, it would let the DC know which then would ship the required items to that branch. In Rexel Australia, the branches are considered as the clients of the DC. As a result, the branches are supposed to place orders as normal customers at the warehouse which then will deliver the products.

However, the branches were not complying enough and instead of placing their orders at the central DC to obtain the products, they were rather ordering directly from the suppliers. This lack of coordination prevented the DC from making accurate sales forecasts and from working efficiently. The reason for that is that the branch had a choice: it could either buy from the DC or directly from the supplier. This made the forecasts of the DC inaccurate since it did not expect such a low compliance. Also, the suppliers themselves approached the branches directly what Rexel did not see coming. Consequently, the general strategy changed and switched back to a more mixed organization because the costs were too high for the achieved results with the centralized model.

Now, each branch has its own purchasing department. Thus, purchasing is decentralized here. The branches and the DC make their own purchasing. Regarding the pricing, it is half-half. This means that if the branch buys from the DC, the pricing is fixed thus centralized. But if the branch decides to buy directly from the supplier, it can still negotiate with them to get local deals and/or cheaper prices which makes it decentralized. About the distribution, again this is both centralized and decentralized. Centralized since the branches can buy from the DC which will then deliver the products to the products. But decentralized since the branches can still directly buy from the supplier.

Despite that Rexel knows this mostly decentralized purchasing structure might not be the most optimal one, the reason of it is twofold: first historical. Historical because as mentioned by Rexel Netherlands, the mindset of the branches is more independent than willing to fully cooperate and depend on a central warehouse. Let us remind that these branches are the result of acquisitions made by Rexel, which formerly belonged to other companies. The cultures might therefore not always be fully aligned since some branches still prefer to work on their own or to deal with only specific clients and suppliers. Historical also because of the distances in Australia. Indeed, the distances between the suppliers and the branches and potentially the central warehouse can be really long which makes it more difficult to monitor from one unique place. Secondly, the reason of this decentralized purchased structure is the lack of data. To centralize all the purchasing departments, a lot of data and information is needed. However, such databases are not easily available or simply do not exist. Indeed, some branches still work mainly manually, without using online databases. Centralizing everything now is thus too complicated, and being decentralized appears to be what works best for Australia at the moment.

3.4.5 Service level

The service level is also decreased because of the centralization as the products have now to go to the DC first then to the branches which increases the total lead time. The employees from Rexel Australia thus believed that here, centralization reduces their service level. This is an additional reason why the company decided to go back to a more decentralized structure since being close to the customers and delivering a service of quality is a golden promise from Rexel.

3.4.6 System

The database of Rexel in Australia was not as efficient as wished. The lack of information and data was really prejudicial as it prevented the company from making reliable forecasts and from achieving their projects correctly. For instance, when customers placed orders for some products, delivering these items was sometimes difficult as the database was not up to date. Finding the products was sometimes complicated as they were not perfectly listed in the system.

3.4.7 Case conclusions

In conclusion, while the fully centralized model scenario perfectly worked for Rexel in the Netherlands, this was different for Rexel Australia which had to aim for a mixed structure. The main reasons for it being the reliability of the data and the culture from the people involved in

the business. While the company had cooperative people in the Netherlands, it appeared that the branches in Australia wanted to keep their independence to a higher scale which prevented the centralization from being efficient.

This illustrates that for a same industry, two markets can be really different and what works for one might not be for the other. The following chapter will discuss the differences highlighted by these two Rexel cases and show to which extent the theoretical findings could apply or not to this applied part. A summary of this Rexel Australia case is made in the following Table 14:

Table 14

Pros and cons of the centralization at Rexel Australia

Pros of the centralization	Cons of the centralization
✓ Better inventory value ✓ Lower distribution costs ✓ Lower handling costs ✓ Increased bargaining power	- Lack of branches compliance - High purchasing costs - Service level not high enough - No reliable database - No reliable system - Too short project time frame

4 Discussion

4.1 Research findings

This section is divided in three parts. First a summary of both the literature and the findings will be developed. Then a comparison between the cases and the theoretical findings will be undertaken.

4.1.1 Literature findings

The literature review developed in the section 2.1 highlighted the key points of both the centralized and decentralized structures, the main conclusions being summarized in the Table 7 (see 2.1.9). See below.

Table 7

The key findings from the literature review

	Advantages of the warehouse structure	
	Centralization	Decentralization
Inventory	- The risk pooling effect and the square root law: lower inventory - Handling costs reduction - Delivery precision improvement - Effectiveness for long delivery times and high density costs products	- The risk diversification - Lower distribution costs - Better service level - Lower delivery time - Effectiveness for fast moving inventory
Purchasing	- Lower costs in the case of all-units discounts - More economies of scale in the case of all-units discounts	- Lower costs in the case of incremental discounts
Human resources	- Reduction in the amount of skilled workers required - Administrative, learning and warehouse staff costs reduction	- Smaller impact of strikes
Corporate social responsibility	- Lower operation costs - Increased sales and customer loyalty - Greater productivity and quality - More ability to attract and retain employees - Benefits to the community, general public and environment	

The main advantages of a centralization are a better inventory level, lower handling costs, improved deliveries, a reduction in the amount of skilled workers needed and lower

administrative costs. The purchasing strategy that suits centralization best appeared to be the all-units discounts. On the other hand, the main advantages of decentralization are the risk diversification effect, lower distribution costs, better service level, lower delivery time and smaller impact of employees strikes. For decentralization, the purchasing strategy that showed the best results for the incremental discounts.

4.1.2 Applied findings

The findings from these two Rexel's cases analysis show that even among the same company, different strategies can be applied and be effective. While Rexel follows a centralized model in the Netherlands, Australia is much more decentralized. Most of the **differences** between the two countries can be explained through different factors such as the country's geography, the population density, the culture and the market situation. The following will develop this in more details.

As mentioned above and illustrated in chapter 3, **the culture and the geography of the country showed having an impact** on a company's strategy at the strategy and distribution level (see 3.3.1, 3.3.3, 3.4.1 and 3.4.3). Regarding the two Rexel cases developed in the previous chapter, the distances involved are totally different. In the Netherlands, with a total area of 41,543 km² and an estimated population of 16,9 million inhabitants, every border of the country can be reached in less than a day by car, which is clearly not possible in Australia with its 7,692,024 km² area and with an estimated population of 23,9 million inhabitants. For instance, the Dutch employees can easily ship their products to their branches on a daily basis. This way, since the branches can obtain the stock from the DC within one day, their stocks can remain low which improves the total inventory level and thus reduces the inventory costs (see 3.3.2). As a result, these branches are more used as sales offices and their role is to be locally in contact with the customers. This means that while it has been decided to centralize the inventory at Rexel Netherlands, the commercial and sales part has been kept decentralized. At the moment, there are 17 branches in the country which ensure this customers coverage across the country. On the other hand, Rexel Australia cannot guarantee as frequent and quick deliveries to their branches as in the Netherlands. This forces the branches to hold more stocks to cover the longer lead times. The Netherlands is thus a country where having a centralized inventory at one single facility is easier to do than in Australia thanks to the smaller distances.

Also, **the way the population is spread across the country can influence** one organization over the other. While in the Netherlands the population is uniformly distributed, it is totally

different in Australia. As a result, having a central warehouse in the middle of the country sounds relevant for Rexel Netherlands as it can easily deliver the products to all the customers in the whole country. On the other hand, since the Australian population is mainly split on the coasts, having a central warehouse for the whole country is not the best option. Therefore, it is better for the company to have some DCs put at the high density areas while having some branches close to the more remoted areas. This is what Rexel is thus doing in Australia but also in the UK for instance where some parts of the country do not require having a central warehouse since the amount of customers is really low but still need the products to be delivered there. As a result, Rexel has a DC in Victoria, in New South Wales and in Western Australia and plenty of branches to deliver the customers.

Secondly, in addition to the distances and the high or low population density areas, **the culture of a country** can be different from one to another and therefore plays an important role (see 3.3.1 and 3.4.1). Rexel illustrated this point by saying that in the Netherlands, the people from the south of the country are really different than those from the north. Also the language spoken is somehow different and it therefore requires sales people to be able to speak it. Being culturally close to the end-customers is thus really important. As a result, having different decentralized sales point with a sales force that understands these customers is a strategic decision. Such customer service can sometimes be really subtle. For instance, Rexel's end-customers are not only big companies. Some "smaller" customers like to walk in the branch, discuss with the sales people before picking and buying their products. Some others would rather prefer to do everything by phone call. Consequently, it is important to be close and enough available for those customers to satisfy their needs and expectations. Some branches managed to develop a really close contact with their customers: for instance, some accept to deliver the goods to the customers and let them pay later. A real confidence relationship has been built over time which is highly valued by these customers and therefore, add value for Rexel in the Netherlands. This is the soft part of doing business, which is according to a Rexel's employee, very important even if is hard to quantify. This is however the reason why Rexel centralized almost all its activities in the Netherlands at the exception of its branches whose crucial role is to be close and deliver a service of quality to the end-customers. On the other hand, it was demonstrated that the culture in Australia was different from the Dutch one. Indeed, as developed in the section 3.4.1, a culture of "we do it ourselves" is present at the Australian branches. The reason behind it being that these branches used to be owned by other (family) businesses. A strong sense of independence is thus remaining while in the Netherlands, even if

some of the branches are also the result of acquisitions, the people's mindset is over this independent culture. This strong culture existing at the branches in Australia represent a key component of the inventory centralization failure in New South Wales. The lack of compliance from the branches to the DC was what mainly caused this centralized system to fail and what forced the managers to go back to a more mixed and decentralized structure (see section 3.4.4). This illustrates how the culture from a country can be decisive and crucial in a company's organization. While both Rexel Australia and Netherlands proceed by acquisitions, the branches from the former were more independent what suits more a decentralized model. While in the Netherlands, such way of thinking used to be true 10 or 15 years ago but has now changed and therefore allows the company to successfully work with a centralized structure.

Thirdly, besides the culture and the geography of a country, **the kind of market in which the company makes business has its importance** (see 3.3.1). This means that in some areas, the market can be more or less competitive. To illustrate this point, the employees from Rexel Netherlands explained that keeping the old decentralized structure would simply be impossible. The reason behind it is that in the Dutch country, being cost-efficient is the key to stay competitive and survive in the business. The costs must then be reduced as much as possible to allow the company to offer the best deals to its end-customers. The company thus had to aim for the organization model that reduced the costs the most. Even if a decentralized structure can potentially increase the service level and reduce the distribution costs, this was not the case for Rexel in the Netherlands. Seen their distribution structure with the hubs (see section 3.3.3), being centralized did not increase their distribution costs nor decreased their service level. On the contrary, the opposite happened: their distribution costs got reduced and their service level improved while the total inventory value decreased. Consequently, the central Distribution Center model (see section 3.2) was thus chosen as it was the most cost-efficient one. Being decentralized was therefore not viable anymore for costs purposes.

However there are not only differences between those two Rexel cases. Some **similarities** can also be highlighted and put forward.

For instance, both companies decided to switch from their previous and old decentralized model, Stand Alone (see section 3.2), to a more centralized one. They both realized that **gains could be made in being more centralized, especially at the inventory level** since they both see it as one of the most important KPI to follow. And for both cases, the inventory value could indeed be decreased. Another really important KPI that both countries agreed on was the service

level which was always considered as a key priority, especially since it is Rexel's promise to its customers.

The next section will compare these findings with the literature.

4.1.3 Comparison between literature and the field

Different advantages of both centralization and decentralization have been put forward in the literature review (see section 2.1.9). After interviewing Rexel employees, it appeared that some of these theoretical findings were confirmed by the interviews while some others were not. The following will thus highlight where theory and practice meet and where they differ.

Overall, the main advantages of both organization models were agreed by Rexel in both countries. However, these models were not always easy to apply for some of the reasons mentioned in the previous sub-section (see 4.1.2) such as the culture and the kind of market in which the company evolves).

The following will developed where the **literature and the practice meet**:

Both countries showed that being centralized leads to a **reduction in inventory value** which confirms Zinn et al. (1989) and Wanke & Saliby (2009) who demonstrated that the safety stocks are always lower in a centralized system. For instance, cycle stocks and especially safety stocks could be reduced as less branches were open or at least, they were carrying less inventory (see 3.3.2 and 3.4.2). Rexel Netherlands thus **confirmed the risk pooling effect and the square root law** (see 3.3.4) developed in the theory (see 2.1.3). The company indeed confirmed that by piling up the demand for an item, the "historical demand patterns" (as they call it at Rexel Netherlands, see page 52) for this item are aggregated and make the item behaviour easier to predict in terms of sales and stocks and also reduce the needs in safety stocks. This reduction was even bigger than what is found in the theory by Wanke & Saliby (2009). Indeed in the theory (see section 2.1.3), the findings from Wanke & Saliby (2009) observed a reduction of 14% of the inventory value from the case studied thanks to the centralization to a unique facility while for the Rexel Netherlands' case, this decrease was about 21,7%. This confirms what Mahmoud (1992) said, knowing that this inventory value decrease might be different as it depends on the spatial settings.

Next to this, centralization also led to many **other costs' reductions** (such as labour costs and in infrastructures needed) and also **improved the deliveries**, as depicted in the theory (Abrahamsson, 1993, see 2.1.3 and 2.1.4).

Also, the **bargaining power** towards the supplier was indeed reinforced thanks to the centralization. However, neither in the Netherlands nor in Australia did Rexel follow its more advantageous deals. Even if buying in larger quantities made Rexel a more important client for the supplier, **this advantage was not enough exploited by the company**. While the theory explains that depending on the discounts' policies, some strategies might be better off (see 2.1.5), Rexel recognizes the added-value of this but had no time to focus on it since it had other priorities. This means that even if the bargaining power is known to be increased, Rexel could not quantify how it would benefit the company in terms of purchasing and costs improvements.

Finally, the literature (Cummings (1995)) and the case study both highlighted the **importance of the constantly evolving environmental circumstances** which impact the organizational model (see 2.1.2, 2.1.5 and 2.1.7). Carnall (1990) explained that since this environment keeps changing, the model used by the company should periodically be reviewed. This is defined by Cummings (1995) as the pendulous movement. Stoner and Freeman (1989) formulated three important factors that define a part of this environment: **the business environment** (such as the market characteristics also put forward by Venable (1996)), **the size and growth of the organization** and finally the **characteristics of the organization** (such as the culture and the top management preferences). All of this has been confirmed by Rexel in the Netherlands and its competitive market (see 3.3) and Rexel Australia and the strong company's culture (see 3.4).

Also, when asked about any **economy of scale** resulting from this centralization, the employees from Rexel could not mention any easily. This confirms what was being said in the literature by Campbell (2003). Indeed, this author explained that economies of scale might exist for centralized structure but are generally hard to observe and achieve. Indeed, no clear economies of scale could be quoted by Rexel employees. Therefore, while economies of scale can be considered and seen as advantages of centralization, this should not be one of the first reason to go centralized.

On the other hand, there also were **differences between the theory and the practice**. The following will develop this in more details:

The decentralized system findings about Rexel were indeed more ambiguous. While the theory quotes that decentralization will improve the company in terms of **reducing the distribution costs and improving the service level**, this was not always be observed. On the one hand, Rexel Australia confirmed that being decentralized helped it to reduce its distribution costs and increase its service to the customers. However, in the Netherlands, the opposite happened. The

service level and the distribution costs were both surprisingly better off in the centralized system (see 3.3.3 and 3.3.5). This contradicts what was developed in the literature by Wanke & Saliby (2009), stating that the distribution costs are always lower in the case of a decentralized system (see 2.1.4). However, this confirms E. Melachrinoudis et al. (2005) who said that the distribution costs could be reduced in a centralized system thanks bigger volume shipments and the benefit of an increased bargaining power. In addition to these two observations, the reduction in the distribution costs could be explained by Rexel Netherlands' distribution network, using a hubs structure that remained the same after the centralization. While there used to be five central DCs and several hubs, the company switched to only one central DC but kept its amount of hubs. This means that the company was not geographically closer or further from its customers (no change of service level at this point). However, the company could pick the products, combine the orders and ship the items to the customers more quickly thanks to being centralized. In addition to this, Rexel Netherlands was able to hire a night shift thanks to the centralization. This allowed the company to work longer hours and thus to handle the customers' orders later every day which also improved the service level. Less complaints from the customers are also recorded thanks to this centralized system. As a result, this disconfirms the theoretical findings saying that the service level is better off with decentralization.

Also, even if the theory and the practice both show that having **a centralized purchasing department is more cost-efficient**, this is not always happening on the field. While Rexel did centralize its purchasing in the Netherlands, this was not done in Australia. The reason Australia is having a decentralized purchasing system is due to their **culture** (the lack of compliance from the branches, see 3.4.1), and the **lack of data** preventing from monitoring the long distances purchases efficiently in the country (see 3.4.4). Consequently, the centralized structure did not work for them, partly because it was too much restricting the independence of the branches and their autonomy. This **lack of autonomy** is a drawback from decentralization mentioned in the definition by Cummings (1995) and Chanson & Quélin (2013) (see 2.1.1). Rexel Australia therefore aimed for a mixed inventory system, which recalls what was developed in the literature review by Cummings (1995) and Lee & Jeong (2009). These authors had indeed pointed out this third organizational model (see 2.1.5) whose objective was the distribution and the inventory costs' reduction. Also, while the risk diversification effect was mentioned as a key element favouring a decentralized system (Schmitt et al. (2015)), such effect was not that crucial in practice. Schmitt et al. (2015) however said that this risk diversification effect was less efficient in the case of low supply disruptions and a reliable system. Indeed, Rexel

Netherlands explained that no major disruptions were occurring during their daily activities. Their system being highly reliable, all the supply disruptions were generally anticipated and thus avoided. As a result, no observation could be made after the centralization in terms of disruptions, underlining the absence of impact of this risk diversification effect.

Next to these differences and similarities between the literature and the case, some **new elements** were brought by the company Rexel which were not really addressed in the theory.

For instance, **having a centralized ERP and VMS system** appeared to be a key factor of success for Rexel in both countries. Having **reliable data** is indeed what is needed to track the performance of the different daily business activities. Without monitoring the data efficiently, nor conclusions nor analyses can be made which then prevents the company from achieving important results. To illustrate this point, Rexel Netherlands' transport department saw its productivity (in terms of service level) increased a lot (see 3.3.5) thanks to a better data utilization. Also, Rexel Australia could not centralize its purchasing departments at the branches because of a lack of data which costs the company a lot of money. Having a successful system has thus positive externalities on every department of the business (finance, transport, inventory, HR, purchasing) since everybody can better use the data thanks to the increased reliability. Besides, the way the data is recorded in the system is highly important. For instance, Rexel works with a "line system" that has pros and cons (see 3.3.4), especially when it comes to register the data in the system and to make sales forecasts based on it. In this case, centralization appeared to be the right choice as it was favouring that line systems.

Also, **the corporate social responsibility** is something that has not been deeply developed in the theory while this can lead to win-win situations in the daily business activities, for the company as well as for its business partners (i.e.: the suppliers and customers) but also for the public and the environment (see 2.1.8 and 3.3.8). The literature indeed mentions the CSR as being beneficial for the company but generally does not clearly link these CSR advantages to the centralization or decentralization thematic.

Finally, **the time frame** on which the company will switch from one model to another is really important. As mentioned in the cases, it is important to carefully consider the time horizon on which the company will achieve its re-organization. On the one hand, it could be observed that in the Netherlands, the productivity was first decreasing but then, finally reaching back a good performance after three years. This means that the whole process was long and took several years to be efficient. On the other hand, Rexel Australia tried to centralize its inventory in less

than a year, going from two or three thousand SKUs to more than twenty thousand. This sudden change led to many issues as the company could not easily monitor this huge new products flow. As a result, it is important for managers to keep in mind that taking the proper time to achieve and to switch to a new model organization is really important.

The following Table 15 highlights what the Rexel cases confirmed from the theoretical findings, what was disconfirmed and what was not mentioned (or not enough) in the literature. The “C” stands for the findings related to the centralization and the “D” stands for the findings related to the decentralization.

Table 15

Comparison between the literature and applied findings

Confirm the theory		Disconfirm the theory	
- C: Inventory value reduction: risk pooling effect and square root law - C: Labour costs reduction - C: Deliveries improvement - C & D: Importance of the characteristics of the market, the environment and the company		- C: Service level improvement - C: Distribution costs reduction - C: Better delivery times - C: Increased bargaining power - D: Risk diversification - C&D: Mixed purchasing (due to culture)	
	Not clearly mentioned in the theory		
	- C&D: An efficient system with reliable database - C&D: The way data is put in the system - C&D: The culture, the geographical and historical background of the country - C&D: The corporate social responsibility - C&D: Time frame		

4.2 Managerial findings

Based on the applied and theoretical results above, some recommendations can be formulated. The following will thus summarize in different pieces of advice what has been discussed all along the thesis and how it can be used to help managers considering a (de-)centralization.

While considering a switch from one structure to another, different **key factors** have been highlighted in the literature review and put forward during the interviews with Rexel employees.

Firstly, the **service to the customer** has been quoted as highly important. It is a priority to always take your end-customers into consideration and make sure you meet their expectations.

Otherwise, markets shares will easily be lost and business will go down. As a result, the service level has to be followed as one of the most important KPI in the company daily activities.

Secondly, regarding the transport level, the interviewees mentioned that the key to success is to **carefully monitor the deliveries**, meaning having a reliable database and also an efficient VMS and ERP systems. It will happen that products are not correctly delivered or delayed. As a result, if the company has its system running correctly, it will be able to find the reasons behind the deliveries issues to prevent these from happening again.

Thirdly, **planning** is believed by Rexel employees to be a key component of success next to the service level. The company needs to have a plan and vision that are achievable. The managers should always pay attention to do things with the right pace and to not rush everything otherwise problems can occur like the example of Rexel Australia and their substantial increase of SKUs stocked at the DC in a too tight timeframe. It is important to know where the company is going and to be able to measure and track the costs involved in the project at any time. As a result, I strongly believe that Australia could efficiently and successfully implement a centralized system in New South Wales. However two conditions have to be met: first and as depicted by the Netherlands' case, a change in the culture has to be achieved. A centralized structure will not work until the branches accept to cooperate more with a central DC. Secondly, the timeframe and the objectives of the centralization should be spread on a longer time horizon than the one they did. Otherwise, the company will be overwhelmed by all the sudden changes in its organization and activities.

Fourthly, the last key performance indicator quoted and that is always followed by Rexel, may it be in a decentralized or centralized system is the **total inventory value**. Huge savings can be made by carefully monitoring the inventory level. It is important to prevent overstocking and useless provisions which will only end up in agonizing stock and too expensive holding costs.

Finally, **the culture of a company** appeared through this Rexel case to have a really important impact on a company's business success or failure. Knowing how your suppliers, your customers but also your own workforce want to work is crucial. Neglecting it or not studying it enough beforehand might lead to some of the issues mentioned in the Rexel Australia's case (see 3.4.1)

Also, Munson & Hu (2010) developed interesting conclusions regarding the **purchasing strategy** of a company and the way it impacts the business (see 2.1.6). Indeed, these two authors showed how, depending on the kind of discounts offered by the supplier which are at stake,

referring to a more centralized or decentralized structure is the best option. However, their findings are quite limited and should still be tested on a bigger amount of computations before assuming they are applicable to all companies. These results can still be useful to managers as they help them to understand how their purchasing configuration may impact their costs and how a change in their centralization degree might affect their business. The negotiation strategies with the supplier are thus assumed to have their importance.

However, managers have to remember that what was theoretically demonstrated in the literature can be applicable for a market but might not be for another one. Indeed and as developed in the point 4.1.3, the kind of market in which the company makes business (i.e.: competitive), the culture, the population density and the distances inside the country play a major role in the success or the failure of a company's organizational strategy. Also, the **time frame** within which the company will work showed having an importance too. For all these reasons, a manager considering centralization or decentralization should pay attention to the findings developed in this thesis but should also **carefully study the market** in which he works. This is confirmed by Cummings (1995) who says that these two strategies have always co-existed. As a result, a company should always **take into account its own culture, its objectives and the environment in which it evolves**. It is also important to note that one strategy will not always be better as these **internal and external factors constantly change**. Only this way he can find the organizational model that suits his company best.

Based on the interviews (see Appendix 3), some recommendations for the young graduated students keen to work in the supply chain field have also been formulated. For these young graduated students recommendations, see Appendix 5.

4.3 Critique

The objective of this thesis was to provide an answer to the research question “*which organizational model, between centralization and decentralization, suits a company best?*” Based on all the above findings, it appears that there exists no single and generic answer to such question. However, some factors can be put forward as having a crucial importance when tackling such topic of centralization and decentralization. Factors whose importance has been discussed (see 4.1) and proven through the theory (literature review, see 2.1) and the Rexel cases analysis (through the interviews, see chapter 3).

The contribution of this thesis to the literature is therefore to highlight how the theory was or not applied in the case of Rexel. The contribution is also to underline other factors than the ones generally mentioned in the literature, and showing their importance while considering the topic. Indeed, while the topic of the centralization and decentralization has already been many times reviewed in the past, applying it to a study case is always enriching since every company is different and can bring its own results and findings which might have not been developed before. However, it has to be reminded that the data collection is biased since it has been gathered within the same company.

Also, while the concrete variables (such as the costs, the service level, the inventory level) are often put forward as the most important factors to look at while considering centralization or decentralization (see 2.1), the theory appears to have not emphasize enough other kind of variables, more abstract. While it is relevant to first focus on measurable data such as the ones developed in the literature review (mainly costs related), this is not enough to successfully benefit from one organization model. As depicted in the analyses, the culture of the parties involved, the features of the country and the kind of market in which the company evolves play a crucial role that needs to be carefully studied beforehand. The corporate social responsibility is also a part of the business that can be beneficial and should therefore not be neglected.

This work should therefore be considered as a relevant tool for managers considering centralization and decentralization as it tackled this topic under both a theoretical and an applied aspect. However, it has to be reminded that the scope of this work was limited to one unique company, Rexel whose business is selling electronical devices. Consequently, while this thesis can later be used a managerial tool, it has to been done with caution. Indeed, all the findings from this work might not be applicable to other companies from the same or other industries or to companies selling different kind of products (with for instance different life cycles).

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