

Optimization of sales in fashion retail by warehouse integration in multichannels

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Abstract

Title: Optimization of sales in fashion retail by warehouse management integration in multichannels

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Issue of study: The thesis studies the optimization of sales in fashion retail by integrating multichannels. The multichannel integration relates to reallocation of articles between brick and mortar store warehouses and online warehouses.

Purpose: The purpose of the thesis is to investigate how increased multichannel integration, in terms of reallocating articles between online store warehouses and brick and mortar store warehouses, affect sales for retailers within the fashion industry. The thesis investigates the potential in increasing the sales by increasing the availability online and by decreasing the share of reductions in price, by reallocating articles to the most suitable channel.

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- Method:** The research was conducted as an embedded single case study with one subunit studying the effects of increasing availability online and the other subunit studying the effects of decreasing price reductions. Data was gathered from four main sources: archival records, documentation, interviews, and observations. The analysis was performed by estimating sales figures if the reallocations had not been performed and compare it to the sales figures after the reallocations.
- Conclusions:** By reallocating articles to the online warehouse, the sales on the reallocated articles increased on average by 67 percent, and had the potential of contributing to an overall increase of 1.2 percent. The sales potential can be further increased by a larger share of the additional store stock a larger share of comparable articles between the channels. The reallocation with the purpose of reducing price reductions contributed to a decrease of 19 percent of the reallocated articles, and an overall decrease in the total price reductions in the online store by 0.4 percent. Reallocating articles between channels with the purpose of reducing price reductions is considered to be less risky in terms of the likelihood of sending the wrong article, than the reallocation purpose of increasing sales, which can be explained by the impact of the short life cycles of the articles in fashion retail and thus the impact of timing.
- Keywords:** Multichannel integration, Availability, Warehouse Management, Fashion Retail, Customer Satisfaction, Optimization of sales, Reductions, Deletions, Best value supply chains: agility, adaptability, alignment

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1. Introduction

The following section introduces the topic of multichannels in fashion retailing and the opportunities that arise when integrating different channels. Thereafter, the thesis' purpose and propositions are presented, followed by its delimitations. Moreover, a brief description of relevant definitions is found in Appendix I - Definitions to ease the understanding of the terminology used in the fashion retail environment.

1.1. Background

Business to Consumer e-commerce is increasing. The trend is global, with a global growth rate of 23.6 percent in 2013, and the growth is expected to continue (Statista, 2015). A study conducted in 2010, concluded that 80 percent of U.S retailers use multiple channels for selling their articles (Zhang et al, 2010). As a result of this, consumers have begun to expect a cross-channel experience where they can research, purchase and return articles through a combination of channels. According to a study performed by IBM, 85 percent of the respondees expected retailers to deliver a unified cross-channel experience (Stelzer, 2011). To meet customer expectations and to grasp the opportunities of increasing sales, an increasing amount of companies expose their offers through a combination of physical stores, i.e. brick and mortar stores and e-commerce. Traditional companies with brick and mortar stores choose to go online, while companies, which have had their foundation online, choose to open brick and mortar stores to increase the credibility of the business (Badrinarayanan et al, 2014).

Aside from the growing consumer demand of multichannel offers, the steady trend of growing e-commerce can also be explained by the sales potential in a multichannel offer. Research indicates that moving from single channel retailing to multichannel retailing has large potential in improved financial performance (Hobbs et al., 2002). The multichannel sales are greater than the possible cannibalisation of the sales in retail stores (Kumar et al, 2007). This can be explained by the different consumer behaviours in the two channels. For example, single-channel customers purchase less than dual-channel customers, i.e. a customer who purchase from two channels such as the online store and the brick and mortar store. (Kumar and Venkatesan, 2005). According to Myers, Van Metre and Pickersgill (2004) on average 20 to 30 percent more money is spent by multichannel customers, since they tend to go through with a purchase more frequently and to purchase more items in both channels (Kushwaha and Shankar, 2005).

The consumers' behaviour differs furthermore between the two channels. For example; the consumers tend to end the visit in a brick and mortar store with a

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purchase more often than when the consumer is visiting an online store, see conversion rate in Appendix I - Definitions. However, the shopping basket online tends to have a higher average value than in the brick and mortar store (Baymard Institute, 2014). Not only consumption behaviour differs between the channels, but also the customer preferences in channels (Blakemore et al., 2002). This means that a highly requested article in the brick and mortar store might have low demand in the online store. The different consumer behaviours lead to both opportunities and risks, which requires strategies regarding how and where to expose the article range in the two channels.

In relation to the opportunities of multichannel strategies, in terms of increasing the customer offer, thus the sales, a multichannel offer also creates challenges in providing coordinated services and put pressure on logistical solutions to serve both channels (Stelzer, 2011). As a result of the arising challenges, multichannel companies were found to have higher sales levels, but lower profits than single channel companies in an investigation performed by Filipe Coelho, Chris Easingwood and Arnaldo Coelho (2003). Coelho et al (2003) put forward that a single channel strategy allowed a more homogeneous and co-ordinated distribution arrangement, whereas one explanation to the lower share of profits in multichannel companies was the increased difficulties in ensuring a consistent level of service across the channels. Multichannel companies were found to have lower grades in terms of customer service and customer loyalty in customer surveys, which indicate that a poorly implemented multichannel offer risk to decrease the customer loyalty, rather than enhance it.

One of the reasons for decreased profitability and customer loyalty is obstacles in the integration of multichannels. Examples of corporate functions to integrate are promotion, product and pricing information management, integrated information access, order fulfilment and customer service (Lin-Bin et al, 2012). However, this thesis focuses on integrating the order fulfilment, and the focus of multichannel integration will be described in further detail in the Literature review in Section 2.2. Even though multichannel integration can strengthen the multichannel offer, market studies indicate that channel integration is not yet realized at retailers, with approximately 70 percent of managers stating that they have not fully integrated their channels (Emrich et al, 2011).

As expected, late deliveries in online stores and stock outs in both online stores and brick and mortar stores have shown to decrease customer satisfaction, which risks to decrease the future sales (Lee and Whang, 2001; Boyer and Hult, 2006). An opportunity that thus arises through multichannel retailing is thus the possibility of increasing availability of articles to the customer through warehouse integration. By integrating the brick and mortar store and online store, in terms of reallocating

articles between the warehouses, it is conjectured that the events of late deliveries and stock outs can be reduced, hence increase sales and customer satisfaction. In addition to increased sales potential, the need for price reduction can decrease since the article can be sold in the channel with a higher demand at a faster rate.

1.2. Purpose

The purpose of the thesis is to investigate how increased multichannel integration, in terms of reallocating articles between online store warehouses and brick and mortar store warehouses, affect the sales, for retailers within the fashion industry. In more detail, the thesis investigates the potential in increasing the sales by increasing the availability online and investigates the potential in decreasing the share of reductions in price, by reallocating articles to the most suitable channel. The purpose will be fulfilled by answering the theoretical propositions presented in the Literature review in Section 2.

1.3. Delimitations in scope

The study focuses on sales potential and not cost effects of multichannel integration in warehouses. Due to this restriction, solely the most significant cost items are considered, which are standardised costs for reallocating one piece from one warehouse to the other. The standardised costs include the transport and warehouse handling such as picking, packing and receiving. Other costs, such as stock-keeping costs are therefore not considered in this research.

In the thesis customer satisfaction is linked to customer loyalty. Customer loyalty refers to a customer behaviour which includes repeated purchasing, a positive attitude, intention to continue the relationship, expressing positive word-of-mouth, and likelihood of not switching or long-term commitment (Davis-Sramek, 2007; Giese et al., 2004). On this basis, increased sales are considered as a result of increased customer satisfaction and customer satisfaction is therefore directly linked to increased sales in the analysis of the result.

The thesis focus on optimizing sales by reallocating articles between multichannels with two channels, i.e. brick and mortar store and online, with two different warehouses. The thesis therefore solely examines how to optimize already completed orders by reallocating articles between the channels, thus optimization of the original order quantities from suppliers will not be considered. The reallocations comprise the total assortment of the case company. It is however limited to two of the markets, the argument for this is described in the method in Section 3.

1.4. Thesis disposition

1. Introduction

This section included a background of the opportunities and the risks that are entailed with multichannel retail and multichannel integration. The introduction also introduced the purpose of the thesis, which is to investigate how increased multichannel integration, in terms of reallocating articles between online store warehouses and brick and mortar store warehouses, affect the sales, for retailers within the fashion industry. Lastly the delimitations of the scope were introduced.

2. Literature review with propositions

The first section of the literature review, Section 2.1.-2.4., introduces previous studies and literature that support the relevance of the propositions that investigate how increased integration between multichannel warehouses affects the sales for retailers within the fashion industry. To be able to answer the propositions, a framework was designed which identified which articles that were reallocated between the channels. The last section of the literature review, Section 2.5., therefore focuses on the logistical aspects of the multichannel integration. The section gives the reader an understanding of the challenges in conducting the reallocation test that was performed in order to verify the propositions, which will later be reflected upon in the discussion in Section 6.

3. Methodology

This section describes the research strategy, how data was collected and how the analysis was conducted. Proposition 1,2 and 3 were answered by conducting a reallocation test, whereas proposition 4, which investigates the potential in reducing price reductions, was analysed by analysing reallocations performed one year ago.

4. Managing physical flows in a multichannel environment

This section introduces the case company and the factors that were considered when designing the framework.

5. Result of implementing the framework

This section gives the success rate of the framework in terms of the demand forecast in relation to the actual sales after the reallocation. This section also answers the propositions and applies the result outside the case specific environment.

6. Discussion

This section highlights the challenges that occurred when conducting the reallocation test by relating the challenges to the literature that covers the multichannel integration in the literature review, Section 2.5.

2. Literature review and research propositions

The literature review aims to give an understanding of the purpose of the thesis by presenting and integrating propositions with previous studies and literature. Later, in Section 3, details concerning the methodology in verifying the propositions are presented.

The first section of the theoretical research aims to give an understanding of multichannels in fashion retail and the benefits and risks of integrating multichannels. The section further describes of how low availability, i.e. events of late delivery or stock outs in the online store, negatively affect customer satisfaction.

Since the thesis aims to investigate how increased integration between multichannel warehouses affects the sales for retailers within the fashion industry, Section 2.5 focuses on the logistical aspects of the multichannel integration. This section gives the reader an understanding of the challenges in conducting the reallocations of articles that will be performed in order to verify the propositions.

2.1. Fashion retail and multichannels

There is a shift of consumer expectations and behaviours in the retail world, where the consumer wants a retailer that offer multiple options. The execution of multiple offers, such as being able to shop through multiple channels and to have the flexibility to choose a delivery date, can therefore affect consumer loyalty and future spending with a brand. The industry is shifting to the trend of reaching a larger customer base through a combination of brick and mortar locations, catalogues, online stores, social networking and mobile devices (Diamond et al, 2015). Multichannel retailing, as described by Levy and Weitz (2009), is a series of activities where merchandise or services are sold to consumers through more than one channel. This can be exemplified through retailers that are operating through brick and mortar stores as well as offering shopping through online stores. The movement to increasing use of multichannel retailing was largely an effect by the fast spread of the Internet as a new option as a selling channel (Zhang et al, 2010).

Most companies in the fashion retail industry introduce new product lines every season, which are sold over short retail seasons, since the products have short life cycles of only a few weeks (Caro & Gallien, 2010). However, the life cycle of an article varies in different product groups, where an article in the basic assortment generally has a longer lifecycle than trend sensitive articles. This entails that fashion retailers face difficulties in balancing the supply and demand on a daily basis (Karakul, 2008).

In combination with the variable lifecycles of articles, the strategy of a firm can put restraint on how to take action upon fluctuations in demand on fashion retail products. An example of this is the price strategy, which can entail the practice of ordering large quantities in advance to attain a low price from the supplier. The fashion retail supply chain management is characterized by long supply lead times, especially if the retailer does not have in-house production. Without in-house production, retailers generally order procurement quantity and product variety well in advance. The literature suggests that orders generally are placed 4–6 months before the start of the season (Mostard et al. 2005). The long lead times and short sales seasons, entails few order opportunities for fashion products (Karakul, 2008). A low cost strategy can therefore result in lower agility for the company since the firm has to estimate the future demand in far advance, a demand which is difficult to forecast due to demand fluctuations caused by seasonality and product popularity within fashion retail.

Article availability is crucial for the fast fashion retailer since the fashion consumer is characterized with a “high-impulse purchase” attitude (Van Donk, 2001). In many cases, the importance of availability combined with the effect of ordering large quantities far in advance leads to a make to-stock approach. This entails that the retailer aims to match the orders or production if the retailer has in-house production, with forecasted consumer demands (Brun & Castelli, 2008).

In order to manage the inflexibility in the make to stock approach, the warehouse management is characterized by a push effect. For example, the push strategy can entail that orders are placed at the supplies before the final customers has placed their order. The opposite of push effect is the pull effect. The pull effects are characterized by being demand driven, i.e. the customer place an order first and when the demand is secured the buying office places the order at the supplier (Hompele & Schmidt, 2007). The push effect entails that the ordering company carries the supply chain's inventory risk if the order is higher than the demand. The stock is typically allocated to a specific warehouse catchment area, whereupon the final customers only have the possibility to purchase articles assigned to the specific warehouse.

2.1.1. Difference in behaviour between the channels

The push strategy entails a risk when the stock is allocated between the two channels if the difference in behaviour between the two channels is not considered. In a study performed by Rohm and Swaminathan (2004), a typology for motivations for shopping online and in the brick and mortar store was developed. The result was the creation of four shopping types; convenience shoppers, variety seekers, balanced buyers, and store-oriented shoppers.

The convenience shopper is motivated by time and effort savings when shopping (Hawes & Lumpkin, 1984; Gehrt & Shim, 1998). The convenience shopper has more of an online store orientation as well as less variety-seeking behaviour across retail channels. The variety seeker is motivated by the need to vary choices of stores, brands or products Raju (1980). The variety seeker has a brick and mortar store orientation and tends to plan purchases and shopping trips. However, for a certain consumer type, the variety seeking was identified as an online shopping orientation since the online store offers the consumer more choices and ease of access. The difference in the motives for brick and mortar and online store orientation for the variety consumer types was that recreational motives were significant in the brick and mortar context.

The balanced buyer is moderately motivated by convenience and variety seeking, and has a brick and mortar store orientation. The store-oriented shoppers are motivated by the desire of immediate possession, which refers to the instant delivery of products or services. The store-oriented shopper is also motivated by social interaction, which refers to consumers' desire to seek out social contacts in retail and service settings (Hawes & Lumpkin, 1984; Westbrook & Black, 1985). Given these four shopping types, the study puts forward that the brick and mortar customer motives were time saving and recreational motives, whereas the online customer was motivated by convenience and variety seeking to a larger extent (Rohm & Swaminathan, 2004).

In 2002, Blakemore, Clarke and Nicholson performed a case study in the same field, which investigated the customers' selection of multichannels of a leading fashion retailer in UK. The study found that the customer choose the brick and mortar store when the customer was in a good mood and that the shopping often was performed as a general leisure activity. Consumers were also more likely to select the brick and mortar store when shopping for pleasure goods, such as a "treat", than for functional items, such as an item for work. The brick and mortar store was also preferred when the customer was performing a purchase for themselves or young children rather than for other third parties. In contrast, the majority of consumers in the study preferred the online store for functional purchases, of which often they had prior experience. The online store was also considered as a way of avoiding social contact. (Blakemore et al., 2002)

The findings in the two case studies therefore indicate that customer segmentation can occur between the two channels. Considering the short life cycles of articles in fashion retail, combined with the difficulties in balancing the supply and demand within push management, the difference in customer preferences can entail both risks and opportunities. However, the mentioned studies do not investigate the potential effects of the differences in customer preferences, in terms of the impact

on demand on specific articles in the different channels. The first proposition will therefore investigate whether there is a difference in demand in specific articles in one channel compared to the other. If there is a difference in demand this can contribute to the understanding of whether article allocation might benefit from not be equal in the two channels or if there is potential in reallocating articles to the channel with the highest demand. The thesis therefore aims to complement the research in this area by investigating following proposition:

Proposition 1:

“The demand between the brick and mortar store and the online store differ in terms of that some articles have higher average demand in one channel compared to the other”

Demand in this proposition refers to the sales compared to the available stock in the two channels. By dividing the number of sold articles per week with the number of articles in stock the two channels demand are compared with each other. If the value is higher in one channel this indicates that the stock sells of faster in this channel than the other, i.e. that the demand in this channel is high compared to what the available stock.

If the proposition is found to be true, there is potential in reallocating articles to the channel with the highest demand, i.e. highest sales/stock ratio. The reallocation of articles between the channels is one step closer to multichannel integration, which is further described below in Section 2.2.

Given that proposition 1 is found to be true, there are several interesting aspects on sales effects that can be investigated. The effects will be investigated in following propositions by reallocating articles to the channel with the highest demand according to a developed framework, see Section 4.2.. There are surely other important effects of the reallocation that are possible to investigate, which can be important to consider in further research of the area, we have however decided to focus on the sales effects presented in proposition 2-4.

2.2. Multichannel integration

Today the multichannel retailing is widespread and approximately 80 percent of US retailers use multiple channels for selling their products (Zhang et al, 2010). Until the past decade different channels primarily coexisted as separate businesses without any integration. However, with the growing expectations from the customers described in the Background, Section 1.1., multichannel retailing is challenging retailers to have streamlined operations and logistical efforts, such as inventory, order fulfilment, product returns and marketing activities (Mollenkopf et

al., 2007). By integrating the channels synergies can occur, such as economies of scale by reducing costs by sharing infrastructure and resources. Inventories can be shared and the integration of information and order fulfilment processes allow self-service, such as order online order and pick up in store, which can reduce the distribution and customer service costs (Chatterjee, 2010). Bendoly et al. (2005) also found that channel integration, can reduce negative outcomes of out-of-stock situations.

By integrating the channels, knowledge about customers' needs, preferences and buying behaviours across the retail channels can increase (Sousa and Voss 2004; Hobbs et al, 2002). For example, channel integration can enable more personalized information, as well as a greater product range (Agatz et al., 2008). Empirical research has showed that retail channel integration, allow firms to be efficient in delivering current offerings and to be innovative in creating future offerings (Cunnane, 2011).

However, despite the benefits entailed with multichannel integration market studies indicate that channel integration is still not yet realized at retailers, with approximately 70 percent of managers stating they have not fully integrated their channels (Emrich et al, 2011). A majority of the multichannel retailers were also found to have separate systems for the different channels in a study made by Cunnane in 2011. The separate systems were found to result in disconnected marketing and unsynchronised operations across retail channels (Cunnane, 2011).

Reasons for the lack of channel integration can be the risk of loss in strategic flexibility for specific channels. It can also lead to increased costs to be able to execute coordinated activities such as order fulfilment, customer service (Sousa and Voss, 2004) and capital investments in information technology. In the Background, Section 1.1., it is also mentioned that a study found that multichannel companies experienced lower grades of customer service and customer loyalty, which indicates that a poorly executed multichannel offer risk to decrease loyalty, rather than enhance it.

In spite of the risks entailed with channel integration, the literature regarding multichannels is in favour of channel integration. Multichannel integration can support flexibility, by enhancing the possibilities to quickly reallocate resources and by configuring new logistical solutions for delivery and inventory management, supported by Benner and Tushman (2003). However, by investigating the potential of reallocating articles between the channels, i.e. enabling order fulfilment integration, the firm needs to have comparable data in the two channels (Kalakota and Robinson, 2014). The integrated data needed in this thesis is thoroughly presented in Section 3.2.1., and includes order quantity data and sales data. By data

integration the firm can get more information on the customer behaviour and allocate the resources across the channels, which strengthen the final offer to the customer (Grewal et al., 2006).

The importance of data integration also concerns one of the key challenges in multichannel customer management (Grewal et al., 2006). Multichannel customer management aims to improve customer value by designing, developing, coordinating, and evaluating channels (Payne and Frow, 2005; Boulding et al. 2005). The ideal position would be complete data integration, such as comparable sales figures and key performance indicators, or a combined view of the customer across channels. However, the different channels have different access to data. The online store can follow the customer behaviour on the site, such as the share of deletions and cart abandonments, whereas it is difficult to get complete data about the customer in the brick and mortar store. For example; a purchase in the store is often completed without providing any identifying information (e.g., cash payment) and it is costly to match store purchases to the customer database (Grewal et al., 2006).

Apart from data integration, key challenges in multichannel customer management are the understanding customer behaviour, allocating resources across channels and coordinating channel strategies (Grewal et al, 2006). By investigating the first proposition, the data involving customer demand in the two channels is made available across the channels and the understanding of the customer can increase (Payne and Frow, 2004). By reallocating articles between the channels, the channels are coordinated and the service level can increase (Straub and Watson, 2001).

2.3. Customer satisfaction

To enable a competitive offer it is important to implement flexible systems that respond to changes in customer demand and inventory uncertainties (Patila & Divekarb, 2014; Snyder & Hamdan, 2009). One of the main challenges in multichannel push warehouse management relates to the article availability online. Availability online refers to offer the customer a full size and article range for the products, which should be delivered within expectations of delivery date. To enable full availability, the articles and sizes must be available in the stock. In the event of low availability online the missing articles and sizes online are visualized by an “out of stock”-message, which gives a negative impression to the customer, whereas the customer is solely exposed to the existing range in the brick and mortar store. In addition, low availability can lead to late delivery in the online store. An example of this is when an article is expecting refill and the retailer decides to offer the article with late delivery date, which does not occur in a brick and mortar store where the customer solely can purchase the existing range.

Online retailers that experience stock outs face declining sales and declining customer satisfaction (Snyder, 2009). When expectations are not met, the customer's perceived value is lowered (Bolton, 1998), meaning that customers experience negative disconfirmation and dissatisfaction (Oliver 1997; Bearden and Teel, 1983; McCollough et al., 2000). The risk of declining satisfaction is that customers switch to competitors or decide to not complete a purchase (Snyder, 2009).

In contrast to declining satisfaction, increased satisfaction leads to increased loyalty, hence repeated purchase activity (Colgate and Norris, 2001). Customer loyalty refers to a customer behaviour which includes repeated purchasing, a positive attitude, intention to continue the relationship, expressing positive word-of-mouth, likelihood of not switching or long-term commitment (Davis-Sramek, 2007; Giese et al., 2004). However, it takes numerous successful order transactions for customers to develop full confidence with online retailers (Tanskanen et al., 2002; Ellis, 2003).

2.3.1. The impact of late delivery

Order fill rate and unit fill rate are often used as operational management measures (Closs et al., 2010). Unit fill rate is defined as the number of units filled compared to the number of units ordered (Bowersox et al., 2007). Order fill rate is defined as number of orders completed compared to the total number of orders (Zinn et al., 2002). However, they may not predict the full impact on customer satisfaction to the operations performance. Rather than solely focusing on minimizing the number of late orders and tracking order and unit fill rates, effort should be taken on when orders are expected to be late, to consider actions to take to minimize the late delivery as well (Goldsby et al., 2011).

One of the crucial metrics to consider regarding the possibilities of improving sales during peak period is the order fulfilment, i.e. order fill rate, which correlates with the inventory availability. For example, if a customer order five units of an article, but solely three are available in stock and can be delivered, the complete order fulfilment will not be reached. Order fulfilment metrics therefore evaluate how well retailers meet customer service standards. According to Barry (2011), most operations regarding consumer goods have 24- to 48-hour shipping standards for in-stock articles, and typically send a high percentage of total orders on the same day ordered.

Failure of deliver on customer expectations are often caused by inventory availability or processing issues. When online retailers fail to deliver upon order fulfilment promises, customers react negatively, especially since shipping and order failure typically occur after payment (Lee and Whang, 2001; Boyer and Hult, 2006).

According to a study performed by Goldsby, Griffis and Shashank (2011), when online retailers fail to deliver to customers within promised delivery dates, this influence future purchase behaviour by reducing orders quantity and order value, as well as reducing the customers purchase frequency. The degree of late delivery of an order therefore has negative effects on the future revenue streams. In contrast, efficient online retail order fulfilment correlates with customer satisfaction and retention (Lee and Whang, 2001; Boyer and Hult, 2006).

2.3.2. The impact of stock outs

Combined with late delivery, the event of stock out is another challenge for maintaining customer loyalty in multichannel fashion retailing. Stock outs result in reduced customer satisfaction, when the customer realizes that the demanded item is not available. Previous research has shown that stock outs reduce the appeal of the product category and create uncertainty from the customer as to which item to select. The negative perceptions affect the firm's image, hence reduce future visits (Zhang & Fitzsimons, 1999). The likelihood of raising a negative perception of the firm is higher impact when highly demanded items are missing and few appropriate substitutes are available (Boatwright and Nunes, 2001, Broniarczyk et al., 1998, Campo et al., 2000 and Sloot et al., 2005).

Stock outs are likely to have a higher impact on customer dissatisfaction and lost sales in the online store, since online consumers generally hold higher service expectations than the average brick and mortar customers (Bloomberg et al., 2002; Seidman, 2000; Kofi and Winston, 2007). As a result, consumers may decide to defer or cancel planned category purchases. i.e. cart abandonment or deletion (see Section 2.4). Key items within a product category, especially in fashion retail, therefore deserve special attention (Achabal et al. 2005).

This has led to different strategies of how to handle a situation when an article is out of stock in key sizes or colours. One strategy is to remove the entire set of sizes or colours from display, in both brick and mortar stores and online. This policy might lower the sales of the sizes left, however the negative customer experience associated with incomplete sets of sizes or colours are considered to be higher than the loss of sales. (Caro & Gallien, 2010)

2.4. Reallocation potential

The event of low availability causes low customer satisfaction, hence decreases the sales. One way to measure the impact of low availability on sales is to analyse the share of cart abandonment and deletion. Cart abandonment refers to the event when customers put items in their online shopping carts online, but leave the

webpage before completing the purchase (Kukar-Kinney & Close, 2010). Deletions refers to the event when the customer has purchased the shopping cart online, but cancels one to all of the items in the basket before the order has been delivered.

According to a study performed by Baymard Institute, the average cart abandonment rate for online retailers is approximately 68 percent (Baymard Institute, 2014). Many studies have been performed to investigate the reasons for cart abandonment, where lack of availability of the articles is identified as one of the main reasons (Kukar-Kinne & Close, 2010). There is limited research on to what extent the cart abandonments or deletions can be explained by low availability, but according to a customer survey performed by the case company in 2014, two of the main reasons for cart abandonment and deletions, were due to late delivery for one or more of the items in the basket or since an article the customer wished to purchase was not in stock, i.e. not available for sale. Thus by offering higher availability, the cart abandonment and deletions can theoretically decrease.

If the retailer has the same article range available in both channels, and there is a difference in demand between the two channels, there is an opportunity to reduce the stock out in the channels or reduce the number of events of late deliveries online by reallocating goods. This opportunity has high potential in the event of a push strategy, where one article might be demanded in the online store but only be available in stock in the brick and mortar warehouse (Cachon, 2002). The same type of reasoning can be done in reverse since there also is a risk of one channel being over allocated with an article with a higher demand in another channel, leading to unnecessary price reductions of an article that could potentially be sold at original price. By avoiding stock outs and late deliveries by reallocating articles, the firm can compensate one channel's weakness with another channel's strength (Achabal et al. 2005), hence charge higher prices and reach higher margins (Fang- Fang and Xing, 2001; Zettelmeyer, 2000).

Low availability of stock often results in two events; late delivery or out of stock. These two events have a negative impact on customer satisfaction, which refers to a customer's overall or global judgment regarding the extent to which product or service performance matches the expectations (Anderson & Sullivan, 1993; Davis-Sramek et al., 2007). Given the events of stock out and late delivery, the focus on increasing the availability online can therefore have positive impact on the total sales for the company. Since the average order value online on average is higher online than the average shopping bag value in the brick and mortar store, the impact on the total sales can increase to a larger extent. That is to say, if the customer finds the demanded article online, it can result in additional items in the basket. However, if the demanded article is not available, or has a late delivery date since it is currently out of stock, there is an increased risk for cart abandonment or deletion.

To summarize what is stated above:

1. The average order value is higher in the online store than in the brick and mortar store.
2. The online store conversion rate is lower in the online store than the conversion rate in the brick and mortar stores, i.e. the cart abandonments and deletions are higher online than in the brick and mortar store.
3. One of the main reasons for cart abandonments and deletions is low availability, i.e. events of late delivery or out of stock.

An opportunity that arises through multichannel retailing is thus the possibility of increasing availability of articles to the customer in the online store through warehouse integration. By integrating the brick and mortar store and online store, in terms of reallocating articles between the warehouses, the number of events of late delivery and stock outs can be reduced, hence increase sales and customer satisfaction. In addition to increased sales potential, the need for price reduction is assumed to decrease since the articles can be sold in the channel with a higher demand in relation to the available stock.

The first proposition is investigating whether there is a difference in demand in the brick and mortar store and in the online store. By identifying articles with high demand compared to the available stock, in the online store, the articles are classified as key items, which are essential for the customers to complete a purchase, whereas a key item which is not available risks a cancellation of a complete shopping basket (Achabal et al., 2005). The articles with high demand in the online store and with low demand in the brick and mortar store compared to the available stock, are thus classified as not being a key item in the brick and mortar store, i.e. the article is not an article that initially bring customers in to the brick and mortar store and thus increase the total sales. If an article is not a key item, the article can be replaced with similar items.

Considering that firms choose to pull back articles due to missing sizes and colours, there is potential in increasing availability to either reduce loss in sales due to pullbacks or to reduce the negative customer perception when low availability occurs. Since the shopping basket online tends to have a higher average value than in the brick and mortar store the availability potential in increasing sales will be investigated in by reallocating articles with high demand in the online store.

By investigating the first proposition by identifying articles that are classified as having low impact on the sales in the brick and mortar store, whereas the reallocated articles is considered to have high impact on the sales in the online store the second proposition can be investigated. Since the purpose of the reallocations is

to increase sales from a multichannel perspective, it is important that the increased sales online do not compromise the sales in the brick and mortar store.

Proposition 2:

- a. *“By reallocating articles, the sales in the online store will increase by the value of the reallocated articles within the given demand period.”*

- b. *“The reallocated articles will contribute to increasing the total sales across the channels, i.e. the reallocations will not decrease the sales in the brick and mortar store and will increase sales in the online store during the demand period.”*

The reallocation of articles performed to investigate proposition 2 and 3 are based on the decision rule in Section 4, and performed in one direction, from the brick and mortar store to the online store.

Proposition 2 a) investigates the reallocated articles impact on the sales in the online channel, whereas proposition 2 b) investigates the effect the reallocation has on the case company in total, i.e. gives a multichannel perspective on the reallocations. Proposition 2 b) will be fulfilled by investigating two conditions; the reallocated articles should not have sold out in the brick and mortar store and should have increased the sales in the online store during the demand period.

The reason for the direction of the reallocation flow, from the brick and mortar store to the online store, apart from the higher order value in the online store and the potential in reducing late deliveries, is since the thesis investigates the potential of increasing availability online in terms of deletions. The data needed to evaluate the effects of the reallocations, such as data of customer behaviour in deletions, is accessible to a larger extent in the online store compared to the brick and mortar store, which also advocates the reallocation to the online store. The third proposition therefore aims to investigate if the increased availability online, caused by reallocating articles to the online store, decreases deletions.

Proposition 3:

“Reallocation of articles to the online warehouse will decrease the average share of deletions for companies in fashion retail.”

In addition to proposition 2b), which gives an multichannel perspective by investigate weather the reallocated articles contributes to the total sales by not decreasing the sales in the brick and mortar store, proposition 4 investigates weather reallocations can benefit the channel which is sending articles to the other

channel. The final proposition therefore investigates the potential positive effects on reallocations in the perspective of decreasing need for price reductions.

Proposition 4:

“Reallocation of articles to the channel with highest average demand in relation to the allocated stock will contribute to reducing price reductions.”

Proposition 1, 2 and 3 are verified by designing a framework with decisions rules for reallocations, performing reallocations and analysing the result. Proposition 4 is answered by analysing previously made reallocations, due to the need of data of the final share of price reductions that would demand a timeframe outside the thesis. In the Methodology, Section 3, it is described how the four propositions are answered in detail and the implications of the chosen method to investigate the reallocation potential.

2.5. Supply chain integration

Given the presented literature in favour of multichannel integration and the potential in reallocating articles between the channels, which the propositions aim to investigate, the framework in Section 4.2. will be implemented to measure the effect on the sales figures. However, the integration of multichannels to enable reallocations puts pressure on the supply chain, which should be taken into consideration before integrating the channels supply chains. Following section will therefore describe the challenges in the logistical solution of integrating multichannels in in terms of agility, adaptability and alignment.

2.5.1. Logistical challenges in multichannel integration

Adding new channels and integrating channels with each other raise a need to redesign the logistics infrastructure [Coelho & Easingwood, 2008; Xing et al., 2010]. Yet the multichannel retailing literature implies that retailers can use existing logistics infrastructure to support new and multiple channels (Goldsby et al., 2009).

Operating through multichannel retailing entails operational difficulties. One example is effective handling of the distribution centres. In the traditional brick and mortar distribution centres articles are moved in cartons with truck, which often remain in the distribution centre for less than a day. The distribution in the brick and mortar warehouse is designed to move merchandise cartons with minimal handling, as opposed to distributions centres designed to support online channels where cartons instead are dismantled into individual items. The individual items are thereafter ready to be picked, repacked, and delivered to individual customers. By adding an Internet channel, the brick and mortar distribution centre needs to adapt and be able to dispatch single items from a distribution centre directly to the customer.

Conversely, online-only retailers adding a brick and mortar store channel need to be able to deliver articles in cartons from the distribution centres to brick and mortar stores, which are broken down into individual units to sell to the customer in the store. (Zhang et al., 2010) Furthermore, the channels may cater to different customer needs, requiring different merchandise in the different distributions centres. These operational differences drive many retailers to have separate organizations in handling the distribution centres (Zhang et al, 2010).

2.5.2. Best Value Supply Chain: agility, adaptability and alignment

Supply chain management is traditionally considered as a process for obtaining and moving goods and services. Supply chains are therefore viewed as tactical and transactional, as well as a cost centre rather than a revenue driver. However, the

theory of best value supply chain is grounded in a different set of assumptions. In this perspective, supply chain management creates competitive advantages and enhance firm performance (Hult et al., 2004; Ireland et al., 2007).

The focus shifts from solely maximizing speed, which refers to the supply process' time duration from initiation to completion, and puts speed in relation to three other competitive priorities; quality, costs and flexibility. Quality is the relative reliability of chain activities, whereas cost refers to activities that enhance value by reducing expenses or by increasing customer benefits for the same cost level. Flexibility is the supply chain's responsiveness to changes in customer demands (Calantone et al., 2006). According to the Best value supply chain theory, by balancing the four metrics, the highest level of total value can be obtained (Hult et al. 2004).

Best value supply chain management also has a different approach to agility, adaptability and alignment (Lee, 2004). Agility refers to the ability to rapidly respond to changes in supply and demand. Agility can be improved through the use of buffers in stock, however decreased costs in deploying information systems have enabled supply chains in recent years to reduce inventory buffers. Buffers and improved information flows come at an expense, which should be taken into consideration when investigating the opportunities in a value supply chain. (Hult et al., 2008)

Adaptability is the capacity to reshape the supply chain. A single supply chain for a customer is generally desired, since it reduces costs, however the need for adaptability might require multiple solutions to satisfy customer needs, such as the increasing demands for multichannel offers (Diamond et al, 2015).

Alignment represents the consistency in the interests of all actors in a supply chain. Alignment can be accomplished by incentives or by collaborating in activities such as forecasting with suppliers and customers. Alignment increases shared understanding and rapid information transfers between the actors. (Hult et al., 2008)

The theory of best value supply chains challenges the traditional logistic approach, by emphasizing a holistic logistical value proposition and the value of positioning inventory, which creates a need for a flexible supply chain structure (Bowersox et al., 2007). Best value chains stress high customer impact, consistent performance and optimal inventory management. The firm's size, as well as number and geographical spread of logistical networks, affects the four competitive priorities. Due to this, a key feature of best value supply chains is to position inventory to achieve the desired time, place, and possession benefits at the lowest practical cost. (Hult et al., 2008)

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To optimize a supply chain strategic logistic value, all critical operations must be integrated and flexible. However, most supply chains have little flexibility or lack pre-planned contingency strategies to prevent logistical failures due to a flexible structure. The flexibility allows firms to quickly respond to demand in article offerings and being at the forefront of customer responsiveness in service. (Hult et al., 2008)

The multichannel integration test of reallocating articles to answer the propositions will be challenging in a best value supply chain management perspective, since the goals of adaptability, agility and alignment become more complex. However, the implementation of multichannels and integration of the multichannels, such as reallocation of articles, is considered as an aim to satisfy the customer need, i.e. to increase the adaptability, in this thesis.

Reallocating articles from the brick and mortar store warehouse to the online warehouse is also viewed as an attempt to increase the agility of a firm, in other means than increasing buffers, since increasing buffers are not preferable in fashion retail due to the risk of future price reductions for excess inventory. However, the reallocations demand alignment, i.e. the consistency in the interests of all actors in a supply chain, in the two channels. To align the actors in the online store with the actors in the brick and mortar store can be challenging, since there is a risk that the two channels are trying to optimize their own performance. For example, both channels are likely to wish to keep the best-selling articles and reallocate the articles that risk reductions in price.

Due to this, it is of interest to analyse how to reallocation of articles can optimize the total sales of the firm. By showing the potential of increasing article availability, the attitude of integrating the multichannel supply chain can change and the supply chains alignment can increase, which in turn can enhance the adaptability and agility.

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3. Methodology

The purpose of this section is to provide the reader with the procedure of conducting the research. It will start by outlining the arguments for the selected research strategy, followed by an explanation of the data collection, and lastly how the data was analysed.

3.1. The research strategy

There are several different approaches of conducting research. Which approach is most suitable, depends on the nature of the research (Yin, 2003). In this report case study was the chosen research design. The reason why case study was chosen alongside the definitions of the case and the selection process are described below.

3.1.1. Choosing the case study as research design

Since the thesis aims to gain a deeper understanding of the effects of multichannels, the study was conducted as a case study. A case study can be defined as an in depth study of a particular situation rather than statistical studies of larger populations, and it brings understanding to complex problems and add strength to previous research (Stake, 1995). By doing a case study, more extensive research was conducted in measuring sales effects of reallocations between warehouses compared to other research strategies. For example, one part of the research that was crucial for the study was the reallocation test where articles that had higher potential in the online store were reallocated from the brick and mortar store. The reallocations entailed the possibility to spend time at the case company and therefore perform observations, which brought important perspectives to the research. These perspectives would not have been addressed if following another research strategy since there would be limited time to conduct reallocations at more than one company. Furthermore, Yin (2003) is arguing that the case study is suitable when researching a contemporary and complex phenomenon that is difficult to distinguish from the context, which applies to the process of warehouse integration in this thesis.

The research was carried out by gathering both qualitative and quantitative data, as seen in Section 3.2. The reasons for following both approaches was to fully grasp the context in which the process of warehouse integration exists, and therefore not only rely on quantitative data, but include qualitative data as well. A common misconception conducting a case study is to synonymize it with qualitative research (Yin, 2003), but several researchers claim the opposite. Yin (2003) argues that case studies can include and even be limited to quantitative research. Bryman and Bell (2007) however mean that the case study as a research strategy is questionable

when only dealing with quantitative data, and in such occasions suggest to evaluate other strategies such as cross-sectional research designs. Ragin (1992) argues that both quantitative and qualitative approaches have their own advantages and disadvantages; quantitative research that focuses on variables loses descriptions and important contextual information, whereas qualitative research lacks distinct explanations and the possibility of making generalisations. In this thesis the best results can be therefore be achieved by combining a quantitative and qualitative approach.

3.1.2. Defining the case and the subunits

Since the thesis studies the process of warehouse integration, it is the process that defines the case. The study was comprised of two subunits of warehouse integration processes, described below.

Case: Company X

Subunit 1: Market A in Company X and the pursuit of multichannel warehouse integration.
Time span: week 12 2015 - week 18 2015.
Unit of analysis: The process of warehouse integration, increasing sales

Subunit 2: Market B in Company X and the pursuit of multichannel warehouse integration.
Time span: week 30 2014 - week 4 2015.
Unit of analysis: The process of warehouse integration, reducing price reduction

The subunits took place within the same company, an international player in fashion retail, however in different markets. Subunit 1 had never conducted reallocations between different channels and the reallocation test was therefore executed at this market. The direction of flow was from the brick and mortar store to the online store and the reason for this is outlined in the paragraph below.

An important aspect that was considered when designing the case study was the small business share of the online store compared to the brick and mortar store share of business in the case company. This implies that warehouse integration mainly can counteract problems occurring at the online store, which was the reason for the direction of the reallocation flow from the brick and mortar store to the online store. The direction of flow is also supported by the thesis's aim to investigate the potential of increasing availability online in terms of deletions. The data needed

to evaluate the effects of the reallocations, such as data of customer behaviour in deletions, was solely accessible in the online store compared to the brick and mortar store, which also advocates the reallocation to the online store.

The time span of subunit 1 was dependant on how long period of time the reallocations were performed and when the effects of the reallocations could be measured. The reallocations were performed as four separate reallocations over four weeks and the effects of the reallocations were shown within two weeks after the reallocations, the reason for this is outlined in Section 4.2. The first reallocation, performed in week 13, required data from week 12, why the total time needed to perform the reallocation test resulted in seven weeks.

Subunit 2 was characterized by over allocation at the online channel warehouse and the crucial success factor was therefore to move the right article from the online warehouse to the brick and mortar central warehouse to avoid unnecessary price reductions. Reallocation between the online and the brick and mortar warehouse in subunit 2 had already been performed prior to this study, but not analysed by the case company. The timeframe of analysis was different from the one described above since reallocations in subunit 2 dealt with other implications. The allocations were executed one year ago, between week 30 and week 35, and since the sales period starts at the end of the season, the effect of the reallocation was measured during a longer period of time compared to subunit 1.

3.1.3. Selecting the cases

Due to the high ambition in the data collection in qualitative case study design, the selection of cases is argued by Lincoln and Guba (1985) to be made based on purposeful sampling. The purposeful sampling enables selecting information rich cases for in depth study. When the research area was decided, the decision was made to study only a limited number of subunits in order to be able to include the various kinds of data sources described in Section 3.2, that were needed to carry out the depth study of the phenomena of multichannels.

When selecting the case and the subunits, it was also important to decide whether to do the selection based on typical or unique characteristics in relation to the research area (Yin, 2003). Since it was the phenomena of multichannels that was of interest in the thesis, as oppose to the specific circumstances of the case, the selections were made based on choosing a case and subunits that had typical characteristics.

The single case study was conducted as an embedded single case study since we wanted to study different effects of warehouse integration in line with the

propositions. The embedded case study entailed that different units of analysis were studied (Yin, 2003); the process of warehouse integration increasing sales, and the process of warehouse integration, decreasing price reduction. This way of conducting the case study contributed to broaden the empirical basis of the study.

In order to fulfil the purpose of the different propositions in terms of increased sales and decreased price reductions, several aspects was important to consider in the selection process. Below the criterias' for choosing the case and subunits are described.

The case:

- is a company in the seasonal based fashion retail industry
- operates separate warehouses for the online store and the brick and mortar store
- orders the apparel in advance of the selling season and has limited possibilities of changing the order timing and quantities of the orders.
- has accessible data on sales figures which are comparable between the different channels

Each subunit:

- has isolated markets with one brick and mortar warehouse and one online warehouse, only delivering to that specific market
- has geographical distance, which allows for reallocations within the same week as the reallocation is ordered.

3.2. Data collection

Data was gathered from four main sources, archival records, documentation, interviews, and observations. The different sources of evidence contributed to a deeper understanding of the phenomena and put the quantitative figures in a context. Yin (2003) emphasizes the importance of using different sources in order to achieve higher validity and reliability of the study.

3.2.1. Using sales reports as archival records

The sales reports are records that demonstrate information on how the articles perform in terms of sales but also show information regarding when refill on the articles will occur and number of articles in the warehouse stock. The sales reports were the key source in the empirical data gathering as well as the analysis. The strength of the sales reports is that it provided the study with quantitative information (Yin, 2003). The sales report served different functions throughout the different phases of the study, which are described below as pre study, reallocation

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test, and analysis. In total, below presented measures were withdrawn from the sales reports. The usage of the different measures will be described more thoroughly in the different phases.

- Division
- Garment group
- Price TSEK
- Sales demdel TSEK, online
- Sales gross TSEK, brick and mortar
- Sales net TSEK, online
- Sales net TSEK, brick and mortar
- Sales demdel pieces (pcs), online
- Sales demdel pcs, brick and mortar
- Stock indoor pcs, online
- Bought pcs, online
- Additional store stock pcs, brick and mortar
- Stock indoor pcs, brick and mortar
- PI, brick and mortar
- Sizes in the online stock the day of the reallocation
- Deletions percent, online

Pre study:

The sales reports were used in a pre-study in order to estimate the sales pattern throughout the period the reallocations in subunit 1 were executed. It was an important step in determining the demand and thus quantities of the reallocated articles in the reallocation. To grasp seasonal fluctuations in different product categories following measures were withdrawn:

- Division
- Garment group
- Sales demdel, online w12 - w15 2014

The sales pattern from corresponding period previous year is a good indication of seasonal fluctuations, however not sufficient since there are changes in terms of sales activities and bank holidays between 2014 and 2015. This was handled by reviewing data from other sources, described further in section 3.2.2 and 3.2.3.

Besides estimating the sales pattern, measures from the sales reports also functioned as a foundation in composing the framework for reallocation of articles for the live test described in Section 4.2. The function of the framework was to screen which articles that should be reallocated. To grasp the scope of the live test, and to set the threshold values, data from last year during the same season was

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elaborated with. This resulted in an estimation of how many units that could be expected to be moved from the brick and mortar additional store stock warehouse to the online warehouse. The elaborations gave insights in how many articles that had the potential of increasing the availability online by reallocating from the brick and mortar warehouse. The measures stated below follow an example on the measures that was extracted during one week of elaborations, in this case, week 12 2014.

- Division
- Garment group
- Price TSEK
- Sales demdel TSEK, online w12 2014
- Sales net TSEK, online w12 2014
- Sales demdel pcs, online w49 2013 - w12 2014
- Stock indoor pcs, online w12 2014
- Bought pcs, online w12 - w28 2014
- Additional store stock pcs, brick and mortar w12 2014
- PI, brick and mortar w12 2014

The above stated measures functioned as a tool for producing threshold values presented in Section 4.2.5. and review how different levels of the threshold values affected the decision on which articles that should be reallocated from the brick and mortar warehouse to the online warehouse. To grasp the prerequisites for reallocating goods in subunit 1, the sales figures above were combined with data from the interviews in Section 3.2.3. and documents in Section 3.2.2.

Reallocation test:

The reallocation test was a crucial part of the research, as it provided the research with real time data on the potential of multichannel warehouses. Data from the sales reports in this phase of the research functioned as a screening tool for extracting the articles by using the framework. The measures used from the sales reports during this phase were the same as in the pre study, but with sales figures from 2015 instead of 2014. The measures stated below follow an example on the measures that was extracted during one week of reallocations, in this case, week 12 2015.

- Division
- Garment group
- Price TSEK
- Sales demdel TSEK, online w12 2015
- Sales net TSEK, online w12 2015
- Sales demdel pcs, online w49 2013 - w12 2015

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- Stock indoor pcs, online w12 2015
- Bought pcs, online w12 - w28 2015
- Additional store stock pcs, brick and mortar w12 2015
- PI, brick and mortar w12 2015
- Sizes in the online stock the day of the reallocation

Analysis: The measures from the sales reports that were used in this phase of the study are described below. The procedure for using them in the analysis is described in Section 3.3.

- Price TSEK
- Sales demdel TSEK, online w12 2015 - w18 2015
- Sales demdel TSEK, online w32 2014 - w4 2014
- Sales gross TSEK, brick and mortar w34 2014 - w4 2015
- Sales net TSEK, online w32 2014 - w4 2014
- Sales net TSEK, brick and mortar w34 2014 - w4 2015
- Sales demdel pcs, online w12 2015 - w18 2015
- Sales demdel pcs, online w32 2014 - w4 2015
- Sales demdel pcs, brick and mortar w12 2015 - w18 2015
- Sales demdel pcs, brick and mortar w34 2014 - w4 2015
- Stock indoor pcs, online w12 2015 - w18 2015
- Stock indoor pcs, online w32 2014 - w4 2015
- Additional store stock pcs, brick and mortar w15 2015 - w19 2015
- Stock indoor pcs, brick and mortar w34 2014 - w4 2015
- Deletions percent, online w12 2015 - w18 2015

3.2.2. Reviewing documents produced by the case company

The review of the pre-study done by the case company, gave insight into the case company's knowledge in the field of warehouse integration. This primarily functioned as a foundation in the analysis of availability, since it provided in-house research on cart abandonments and deletions. The other documents presented below were also reviewed, with the purpose of combining them with data from the sales reports in Section 3.2.1. to compile even more accurate sales pattern and framework. The activity plans for 2014 and 2015 were important documentation, since it has a major impact on the sales pattern and thus provided a deeper understanding of the fluctuations. The factors that mainly affected the fluctuations, besides seasonal changes affecting garment groups such as swimwear, are bank holidays and catalogues. Since these events do not occur at the same time over the years, it had to be adjusted for in the sales pattern forecast for 2015. The mid-season sale document functioned as a screening factor in the framework, as articles on sale were excluded since price reductions are performed to compensate for low

sales figures for the article. Following the same argument, the top priority articles document also functioned as a screening factor in the framework, as we did not wish to reallocate top articles from brick and mortar store in order to avoid cannibalism.

- Pre study by the case company
- Activity plans for 2014 and 2015
- Mid-season sale document
- Top priority article document

3.2.3. Conducting unstructured interviews

A significant part of the data gathering was the unstructured interviews with employees. The interviews provided important information on the prerequisites and circumstances of the different cases. The approach of combining interviews with other data is supported by Yin (2003) who argues that the strength of interviews is that it can provide explanations to quantitative figures. The unstructured interview is, according to Yin (2003), common in case studies and can be compared to guided conversations rather than structured inquiries. This unstructured type of interview gave crucial perspectives in the study. By discussing a topic rather than having a predetermined set of questions, the aim of the interview was to gain a rich picture rather than quantify and compare the respondents' answers.

In order to obtain a broad perspective employees were interviewed from different parts of the organisation. Respondents were selected based on emerging and predefined criteria. The different functions that were important to capture was:

- employees from the global head office
- employees who work in the markets where the reallocations were executed
- employees from the online as well as the brick and mortar side of the company
- employees from other key functions, such as the warehouse logistics department

Since new topics arose as the study progressed, some of the respondents were interviewed several times. The topics that were discussed were:

- Implications with the stock levels in subunit 1
- Implications with the stock levels in subunit 2
- Seasonal fluctuations in subunit 1
- Different approaches to avoid cannibalism when reallocating articles from the brick and mortar stores warehouse to online warehouse

A typical interview was between 30-60 minutes long and was conducted at the office of the case company or over the phone when interviewing respondents from subunit 1 and subunit 2. The interview was documented in writing by one of the authors to the thesis while the other author had full focus on the interview.

3.2.4. Performing observations during a live test

The live test was performed at and runned from the case company which entailed that observation could be performed to put the multichannel integration in the context of the case company. Since the live test were performed in real time it was important to note any actions at the case company that could have had an effect on the result. Yin (2003) and Patton (2015) describes that the advantages of observations is that it covers events in real time and can bring a contextual understanding of the phenomena. The data collection followed a causal procedure of noting different behaviours that could have affected the outcome.

3.3. Analysis

The following section will describe the methodology for estimating the demand in the forecast as well as how we evaluated the success rate of the framework. It will thereafter continue by describing the methodology for analysing the four propositions.

3.3.1. Methodology for estimating demand

By solely studying past sales to estimate the future demand, the demand can be underestimated. If the availability is high, the demand is equal to the sales but if the availability is low the sales figures risk being lower than the actual demand, since the availability do not to cover the demand. However, the historical average demand includes the sales figures of the periods with high availability, i.e. when the stock was full, and is therefore considered to be more accurate than solely estimate the future demand from the current sales figures.

However, not only past sales was considered when estimating the demand, since future demand can be higher or lower than past demand. The forecast of future sales were based on the sales pattern from last year. The articles at the case company are divided into divisions and garment groups, such as girls and skirts. Each and every one of these groups has different sales patterns, since they react differently on seasonal changes and events. Therefore data was withdrawn on each division and garment group from last year so that the peak factor in Section 4.2.5 could be set individually for each of these groups.

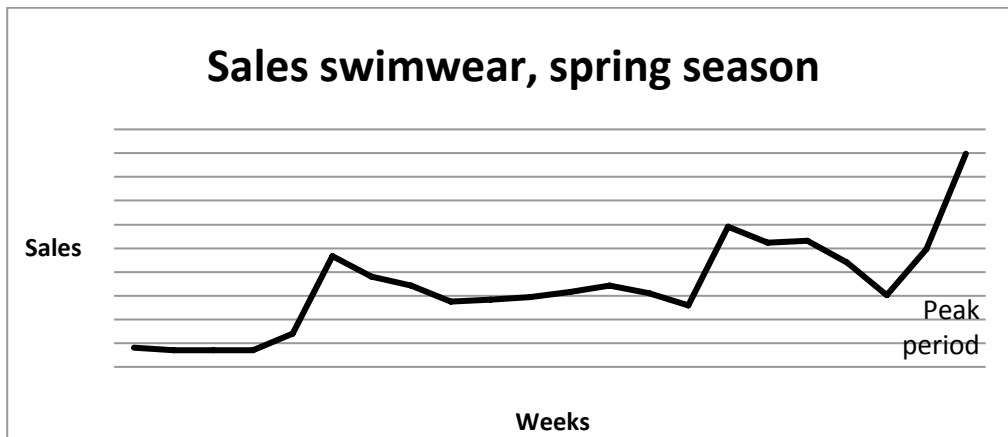
The fluctuations in the sales pattern were derived from two kinds of sources, seasonal changes and events. It was important to understand which kind of source a

peak was derived from, since seasonal changes and events had to be handled differently when transferred into predicting the sales pattern of the current season. The reason for this will be described below.

Seasonal changes:

Some garment groups have different sales pattern through the season. The most evident example of this is swimwear, with increasing sales through the spring towards the summer. Seasonal changes are, as the name states, changes that occur throughout the season, and were therefore set to be the same this season, and not adjusted for. For example, the increasing sales of swimwear last year will most probably occur during the same time this year too.

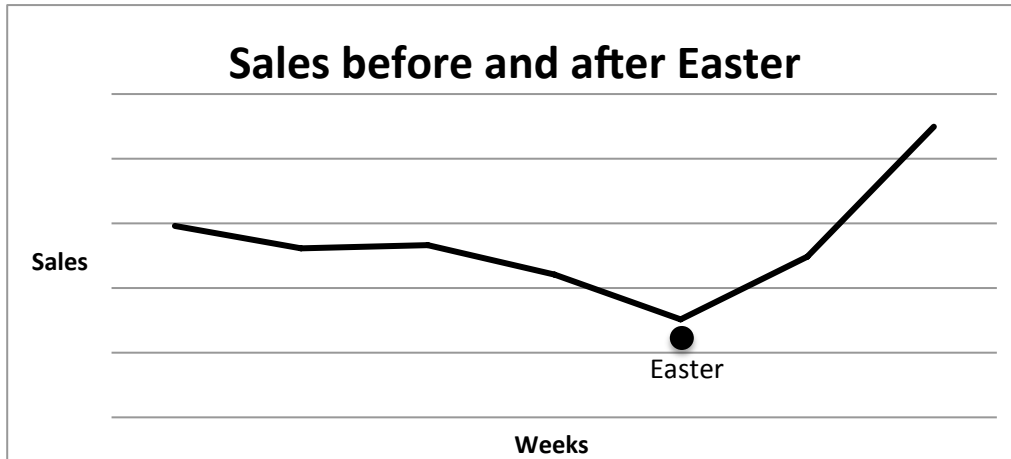
Figure 1. Sales swimwear, spring season



Events:

Events such as catalogues and bank holidays affect the sales pattern throughout the season as well. Bank holidays such as Easter tend to entail lower sales, whereas catalogues generate peaks. Fluctuations due to events were handled differently than seasonal changes when transferred to the current year. One example is Easter that occurred week 16 last year, but week 14 this season. Any potential dip in week 16 last year would most likely change to week 14 instead this season. The same reasoning was applied for handling catalogues. The catalogues last year were distributed one week in advance, and any peaks derived from the catalogues were therefore shifted one week ahead in time this year. The dip in the graph below represent the sales during Easter week 16 2014.

Figure 2. Sales before and after Easter



When mapping of the sources for the different peaks and dips were completed, the actual peak factor was calculated by dividing the sales in a peak, with sales the week before. The forecast did not take into account the expected low sales curves with the purpose of lowering the ratio, since the prioritization of the reallocations was to assure that sufficient products were sent to the online store to increase the availability. The final ratio was thereafter used to multiply with average pieces sold per week (ASW) in the framework, see Section 4.2.5.

3.3.2. Methodology of analysing the success rate of the framework

To be able to analyse if the reallocated articles had sold as the estimated sales forecast in the framework, the forecast had to be adjusted according to the final quantities that were reallocated compared to the requested quantities for each article. This was performed by calculating a ratio for the definite amount, i.e. the actual reallocated quantity for each article, compared with the initially requested amount.

For example if the forecast was 20 pieces, i.e. 20 pieces was estimated to be sold within 2 weeks, 12 pieces had to be reallocated to be able to cover the forecast if the stock already had 8 pieces. The requested amount of 12 pieces was thereafter divided into a size scale of for example 4 pieces in size small, 4 pieces in medium and 4 pieces in large. However in some cases the requested amount could not be reallocated due to missing sizes in the brick and mortar store warehouse. In this example the event of missing sizes leads to that 8 pieces in the sizes small and medium were reallocated to the online warehouse. This results in that the original forecast of 20 pieces could not be sold as estimated, since the total amount of pieces in stock was 16 pieces after the reallocation.

Due to the lower amount of reallocated pieces compared to the requested, the forecast had to be adjusted after the sales potential. The adjusted forecast was decided by dividing the definite amount with the requested quantity, i.e. $8/12=0.67$ and thereafter multiply the ratio with the original forecast, i.e. $0.67*20 = FC 13$ pieces. The reason why the forecast was not adjusted by subtracting the forecast with the missing pieces, i.e. $20 - 12 + 8 = 16$ pieces, was due to the limited potential of increasing the availability when sizes were missing.

Missing sizes also risked limiting the availability in the worst cases. An example of this is when five sizes were requested but solely one size was reallocated. If the sizes in the brick and mortar stock would have been known before the orders were requested, the orders with high shares of missing sizes would not have been performed due to the risk of lowering the customer satisfaction for the customers with the sizes that could not be reallocated. However, the data of available sizes in the brick and mortar warehouse was not available during the test period, which led to a high share, 67 percent, of reallocations with missing sizes, and thus decreased the potential in selling according to the estimated forecast.

Forecast adjustment for specific dates

When the forecast had been adjusted to the definite amount of reallocated pieces per article, each article's forecast was adjusted to the specific date when the two weeks sales figures were measured from. The timing of when the sales figures should be measured was important to take into consideration since it was three specific dates that could affect the sales figure. The forecast, which decided the quantity, was estimated during one specific day, the article appeared on the webpage (with late delivery date since it was not available in stock) during another day and the article was available in the indoor stock yet another day, see Section 4.5 for more details.

By analysing the sales figures from these dates, it was possible to see the impact of the timing of the forecast, i.e. the freshness of the data, the availability on the webpage and the delivery date. It was necessary to adjust each of these dates to the quantities of the indoor stock, since there was a risk that the articles had too low quantities in the indoor stock to cover the forecast.

To adjust the forecast according to the specific dates, rules were decided to ensure accurate estimates. Below the values used in the rules are listed:

FC Forecasted quantity of pieces the article is estimated to sell within 2 weeks to have 0 pieces in the stock on the final day.

Optimization of sales in fashion retail by warehouse integration in multichannels

<i>Qdefinite</i>	The quantity of the article that was reallocated
<i>Stock FCdate</i>	The number of pieces of the article available in the stock on the day the forecast was estimated
<i>Stock Onlinedate</i>	The number of pieces of the article available in the stock on the day the articles became visible on the online store
<i>Stock Stockdate</i>	The number of pieces of the article available in the stock on the day the reallocation was available in the stock, i.e. the reallocated quantity is included in this figure.

Following adjustments were performed to adjust the forecast according to the possibilities to sell the articles in relation to the indoor stock for the specific dates.

Forecast according to the date the forecast was estimated (FC FCDate):

Since the forecast was estimated to two weeks, the first step included to divide the number of days from the FCdate to the day the article was visible on the online store, which resulted in a share of the 2 weeks demand that had to be covered before the articles were visible on the online store. For example if there was 4 days between FCdate and the Stock Onlinedate the share was 0.286. By multiplying 0.286 with the FC, the share of the forecast that must be covered by the number of pieces that are available in the indoor stock from the FCdate was estimated, i.e. $0.286 * FC = X$. If X was larger than the Stock FCdate, and there was no refill week within four weeks, the FC was adjusted to $FC - X + \text{Stock FCdate}$. If X was less than Stock FCdate the FC was not adjusted.

If the adjustment was not performed, the indoor stock would not cover the FC during the days before the articles were visible in the online store. The refill week rule had to be included since the online store sold articles on pending (see Appendix I - Definitions). If the article had a refill week within 4 weeks the pieces in the refill were available for sale on the webpage with a late delivery date.

Forecast according to the date the articles were visible on the online store (FC Onlinedate):

If the Stock Onlinedate + Qdefinite were less than FC, and there was no refill week within 4 weeks, the FC was adjusted to the quantity of Stock Onlinedate + Qdefinite. However if the quantity of Onlinedate + Qdefinite was larger than FC, the FC was not adjusted.

Forecast according to the date the articles were available in the online warehouse (FC Stockdate):

If the Stock Stockdate was less than the FC the FC was adjusted to the Stock Stockdate. If the Stock Stockdate was larger than the FC the FC was not adjusted.

After the forecast had been adjusted to the date, the sales figures were compared to the specific forecast dates, by dividing the sales figures with the forecast. For example, if 15 pieces had been sold from the date the forecast was estimated and the Stock FCDate was set to be 20 pieces, the article had sold 75 percent of the forecast which gave a ratio of 0.75 ($15/20=0.75$). The average ratio for the reallocated articles indicated whether the framework had managed to reallocate articles that sold according to the forecasted demand or not.

In the sales analysis the accuracy in the forecast was compared between the different dates to enable patterns between the weeks. For example if the trend would have been that the FC StockDate had the highest accuracy this would indicate that the delivery date had higher impact on the sales figures than the freshness of the data.

The average ratio was also measured for all articles and in addition, the average ratio for all articles was measured by adjusting the ratio for the articles, which had a ratio over 1 to ratio 1. This was done since the majority of the articles that had sold more than the forecast, i.e. had a ratio over 1, had a refill week within 4 weeks and thus had full availability online in sizes. Articles with the refill week could have a ratio as high as 10, and were adjusted to a ratio of 1 to not affect the average ratio.

Articles could also have a higher ratio than 1 due to returns. For example, the indoor stock could be 10 pieces on the date the sales figures were begun to be measured, but the total sales during the two weeks period of time was 12 pieces, since 2 pieces had been returned and sold a second time. By adjusting the articles with a ratio over 1 to 1 the return effect on increasing sales was limited. However, the return effect was considered to have little effect on the sales figures and therefore not taken into consideration in further extent in the analysis, since the average return for the articles during the season was 14 percent and approximately 50 percent of the returns are returned and received in the stock within two weeks after the day of delivery to the customer, i.e. approximately 7 percent ($0.14*0.5$) would have been returned in the given demand period of two weeks.

Without the possibility of offering customers articles on pending, the return effect or the forecast adjustment due to missing sizes the ratio of 1 is equal to having zero articles in stock.

3.3.3. Methodology of analysing proposition 1

Proposition 1 was verified by implementing the framework, see Section 4.2., through a live reallocation test performed during four weeks. The framework made it possible to conclude how many articles that were identified to be reallocated from two perspectives; with the pre-determined limit of α_2 , and without the pre-determined limit of α_2 . The reason for highlighting both perspectives was to see how many articles that was actually reallocated, but also see the full potential without the restrictions from the brick and mortar store, see Section 4.2.5. If articles were identified, the proposition was found to be true, and the share of articles indicated the extent of the difference in demand between the two channels.

3.3.4. Methodology of analysing proposition 2

The increase in sales online was calculated by comparing sold pieces online and the stock levels online if the reallocation had not been performed. If the sales exceeded the stock level in a scenario without reallocation, the reallocation was contributing to increased sales. This is visualized by the example below.

Example:

Sold pieces: 10 pcs

Stock level without move: 3 pcs

Increased sales: 7 pcs

The example above state that in a scenario without reallocations, it would not be possible to sell ten pieces since there would only be three pieces left in stock. Thus, seven pieces from the reallocation definitely contributed to increasing sales online. It is however important to consider that this will lead to an increased value that is underestimated. This is due to the assumption of that all three pieces in a scenario without the reallocation would have been sold with no consideration taken to the different sizes. This is however the only way of conducting the analysis since there are no sales data on size level.

Sold pieces and stock levels were analysed from two different periods of time:

1. Stock levels in a scenario without reallocation, the day the articles were available online. Accumulated sales from the day the articles were available online and two weeks ahead in time.
2. Stock levels in a scenario without reallocation, the day the articles were available online. Accumulated sales from the day the articles were available in stock and two weeks ahead in time.

The reason for analysing the different time periods described above was to measure if shorter delivery time had an impact on the result. This is important to understand

since articles can be sold on pending. The reason for studying the stock levels from the day the articles were available online in scenario 2 was to eliminate the effect of decreasing stock levels between the day the articles appeared online and the day they arrived in stock could have on the result.

The argument for analysing two weeks was that the reallocations were based on a forecast with two weeks demand, as seen in the framework presented in Section 4.2. Articles that did not contribute to increased sales during the time frame of two weeks, were compared to the stock levels in the additional store stock in brick and mortar warehouse, two weeks ahead in time. If the additional store's stock level was zero, the reallocation was considered questionable, since the articles could potentially have been sold in the brick and mortar channel. The value of the move was therefore calculated to see how much that would have benefited from being sold in brick and mortar store. If the article did not contribute to increased sales online, but still had stock left in additional store stock, the articles did not contribute to any lost in sales in store, and the opportunity cost was therefore zero, except for the standardized reallocation cost per piece.

The total outcome from the reallocations was calculated by subtracting the increased sales with potential lost in sales in the brick and mortar channel and the cost of the reallocation.

The total outcome of the analysis showed whether the performed reallocations were successful. However, the implications of the outcome on the potential of a future integrated multichannel warehouse were also analysed. To do this, the number of pieces that existed in the additional store stock warehouse with lower PI than in the online store was divided by the actual reallocated pieces. The ratio was then multiplied with the outcome from the reallocation.

3.3.5. Methodology of analysing proposition 3

The availability was measured by deletions, which is defined in Appendix 1 - Definitions. The reason for using deletions as a measure was that it is the only measure that can be studied on an article level. Other measures of interest to evaluate the reallocations, such as cart abandonments, can only be studied at a total sales level, and since the reallocation only comprised 1 percent of the total online store, no conclusions could be drawn from such measures.

The deletions on the reallocated articles were studied two weeks before to one week after the different points of time presented below. The purpose of studying the deletions two weeks before was to see if any changes occurred during that time frame.

Two different time frames were studied, the day when the articles were available online, and the day they were available in stock, to see if there were any differences and if any conclusions could be made on when the deletions decreased most. This is interesting since articles are sold on pending in subunit 1, and thus can be sold online before they are physically available in stock.

In order to understand how the deletions on the reallocated articles was affected by the reallocation in total, the mean value of the deletions on the reallocated articles was calculated for the reallocations that were performed week 13 to week 16.

3.3.6. Methodology of analysing proposition 4

To determine the success rate of the reallocations, price reductions in both channels were compared to price reductions in a scenario if the reallocations would not have been performed. If the combined price reductions in the online channel and brick and mortar channel in a scenario where no reallocation would have been performed exceeded the actual price reductions and the cost of the reallocation, the reallocation were regarded as successful.

Stock levels and sales are the measures that affect the need for markdown most. High stock levels and low sales performance will contribute to a higher need for price reductions. The best key performance indicator (KPI) for determining the price reductions in a scenario without reallocations is therefore PI, which is defined in Section 4.2.2. The price reductions in the scenario without reallocations were therefore calculated as inversely proportional to the PI, the constant being the product of the actual PI and the actual price reduction in the reallocations.

One exception to the calculation of the price reduction was made; some deals that are offered are not specific to a certain article, but function as discounts that are set through a range of articles. These types of discount will not be affected by the reallocations. After the interviews were conducted, the level was set at 10 percent, and price reductions below this level were therefore not adjusted for between the scenarios of reallocating and not reallocating.

The PI should reflect the performance of the article after the reallocations, and was therefore calculated as an accumulated PI from four weeks in the brick and mortar store, after the decision of the reallocations was made, until the end of the season. The argument for calculating from four weeks after the decision was that it took four weeks from the decision was made to the difference in stock level was visualized in the data system. Following the same argument, the accumulated PI in the online channel was calculated from two weeks after the decision of the reallocations was made. The figures for calculating PI are sales and stock. Different approaches for determining the potential sales and stock levels in a scenario without reallocations

was required for different outcomes which will be described more thoroughly below.

Stock left in brick and mortar store at the end of the season without move:

The stock was calculated by reducing the actual stock level with the moved pieces. The outcome was that there would be stock left at the end of the season, however lower than with the reallocations. Sales were set at the same level as with the reallocations.

No stock in brick and mortar store at the end of season without move:

The stock was calculated by reducing the actual stock level with the moved pieces. The outcome in this scenario, as opposed to the scenario above, was that the article would have been sold out if the reallocations would not have been performed. This scenario is characterized by that the brick and mortar store received many pieces in the reallocation in relation to the stock before the reallocation. The price reduction was therefore set at 0 percent in the scenario without any reallocations.

No lost in sales online with move:

The stock was calculated by adding the moved pieces to the actual stock level. Sales were set at the same level as with reallocations.

Lost in sales online with move:

When determining the price reductions of the moved articles which were sold out online before end of season, lost in sales had to be adjusted for, and thereafter added to the actual sales. Following the same reasoning, the stock levels had to be adjusted for as well. Stock levels were therefore calculated by adding the moved pieces and reducing lost in sales. Lost in sales was determined by calculating average sold per week of the article over the season and multiply it with weeks without stock.

3.4. Validity and reliability

In the section below the measures in the research are discussed in terms how well they contribute to answer the purpose of the study. The section begins by explaining the validity of the study and later explains the reliability of the study.

3.4.1. Validity

The concept of validity refers to whether the right measurements are used in the study (Bryman & Bell, 2007). Yin (2003) distinguishes between different types of validity. One type is construct validity that deals with whether the correct operational measurements for the study are being used. While withdrawing data from the database, flaws were identified in the system. To maximise the effect of

the reallocation, reallocation decisions should be based on data at the most detailed level, in this case size level. The data system had however limits and sales reports could only be produced at article level on a weekly basis. It meant that articles that did not perform good enough to reach above a pre-specified threshold value α_1 , Section 4.2.5, in total for all sizes on one specific article, were not caught in the framework, and thus sizes that could potentially be in need for refill were not reallocated. The challenges with sizes were compensated for when an article was identified in the framework. When fewer articles were handled it was possible to look up the size range still available in the online warehouse, and thus decide on what sizes that were not in need for a refill. Still, a possibility to handle data on sizes level would have led to an even more accurate forecast on which articles to move from brick and mortar warehouse to the online warehouse, and the outcome of the reallocation test in terms of sales compared to forecasted demand would be higher.

Due to an attempt to avoid a large business risk in the reallocation test, the limit of reallocated articles from brick and mortar warehouse was set at PI α_2 , see Section 4.2.5. This, however, does not mirror the future potential of an integrated warehouse to its full extent, since a scenario with a combined warehouse would send all articles that are first requested in the online store and vice versa. In an attempt to reflect that scenario, the outcome of the reallocation test was scaled up to the level of identified pieces in need for reallocation that was available in the additional store stock. However, some reallocation potential could have been lost, since more highly requested articles would probably have performed even better in the online store than the articles in the reallocation test. The potential of integrated multichannel warehouses is probably therefore underestimated in this research.

Yin (2003) also discusses the importance of external validity, which will look into what extent it is possible to generalize the findings of the study. Bryman and Bell (2007) mean that this is one of the most important measures in a case study. This is one of the challenges and disadvantages with a case study, since a case cannot be representative for all situations of the studied phenomena. There have however been attempts to do theoretical generalizations on the basis of the outcome of case studies (Bryman & Bell, 2007). This is something that was attempted in this study, by discussing the result outside the case in Section 5.3.

3.4.2. Reliability

Reliability refers to what extent the research is trustworthy, and possible to repeat with the same outcome. Stability is one perspective that reliability can be discussed from according to Bryman and Bell (2007). It refers to what extent the measure is stable over time, so that consistency in the result can be achieved (Bryman & Bell, 2007). This has been identified as a challenge in the research, since there are

external factors influencing the outcome of the reallocations. The demand is very difficult to predict for single articles, and therefore an attempt to group them into divisions and garments groups, and predicting their sales pattern was done in the forecast described in Section 3.3.1. However, since the demand is difficult to predict, the benefits of the reallocation can vary between different reallocations, even though the same framework for determining what articles to reallocate and the same procedure for analysing the outcome were used.

The element of uncertainty was reduced in our study since reallocations were performed four times, and thus eliminated any differences in the outcome by looking at the mean value of the reallocations. Potential differences were captured since the timing of the reallocations covered both peaks due to catalogues, and dips due to Easter. The procedure of measuring several times is also a method that is recommended by Bryman and Bell (2007), to limit any differences in outcome. However, since the demand is very difficult to predict, some potential is missed by only performing manual reallocations instead of implementing a fully integrated multichannel warehouse characterized by a pull effect.

Another way to obtain higher reliability was to have a systematic way of organizing the data, as well as determining what articles to reallocate in form of the framework. The thoroughly described procedure of analysing the data, enhance the probability that the same results will be achieved in the future.

4. Managing physical flows in a multichannel environment

This section describes the case, and thus the context of where the reallocations were performed. Moreover the reallocation framework that identified the articles to reallocate is presented by describing the predetermined conditions, key performance indicators and the threshold values the article must fulfil to be reallocated.

4.1. The case company and the fashion retail context

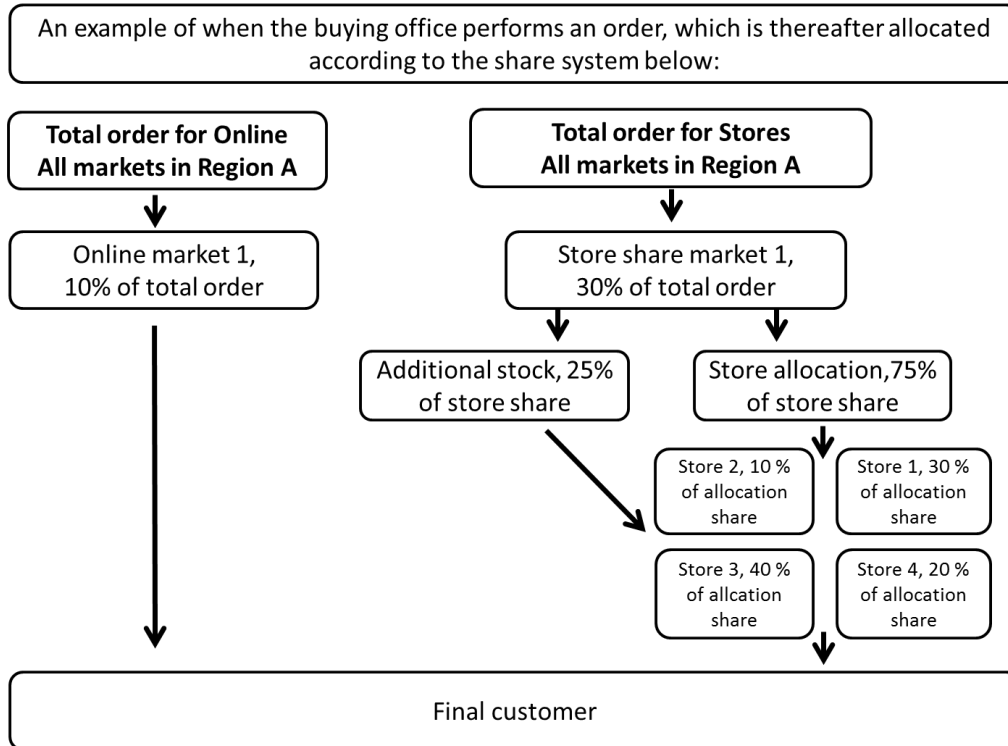
The case company has international presence in the fashion retail industry with both brick and mortar stores and online stores. The multichannel operations are performed separately from each other, i.e. the multichannel integration is considered low from a theoretical perspective. For example; the channels have different marketing strategies, which can result in price variances in terms of channel specific offers and price reductions.

Even though most functions are run independently in the two channels, the buying office is central and conducts the orders for the two channels. The buying office places orders according to the two seasons that occur each year, spring and autumn. The company do not have in-house production, hence the company is characterized by push warehouse management since the articles belonging to a seasons are centrally purchased by the buying office approximately six months in advance. The limited flexibility correlates with low costs. By placing an order six months in advance, the company is able to negotiate the price with the suppliers.

The buying office places separate orders for the online store and the brick and mortar stores. Generally the buying office places one order for a large market, which is later divided into specific regions in the brick and mortar stores and specific countries online. Figure 3. visualize an example with fictive allocation shares, of how the order can be divided into a market. The buying office places the orders according to the total forecasted demand in for the regions or countries combined.

The share allocation for the online store is a time efficient way of working for the buying office. However, it does not optimize the reallocation of goods to the specific online countries or brick and mortar stores in the region, since it does not take into consideration that the demand can differ across the channels and stores in different product categories, such as jeans or trend sensitive products.

Figure 3. An example of push allocation



In a logistical perspective, article availability can be improved by increasing the safety stock (buffers), hence increasing the order quantities from the suppliers. However, fashion articles have short lifecycles, and if the inventory levels are too high for the existing demand, the articles will be sold to discount, thus decrease the profit margin. To increase the availability by increasing the order quantity is therefore not considered as an option for the case company, and is therefore not considered in this thesis, regarding the potential in increased article availability online and in the brick and mortar stores.

Due to the share allocation online, the case company has experienced increased difficulties in obtaining availability online, especially when the company has expanded into new counties. The company has experienced two events due to the set share allocation;

- a) if the availability is low online in relation to the demand, the customer experience will be reduced, which decrease the future sales online.
- b) if the online store share is too high, the articles will be sold at a discount and the total profit margin will be reduced.

The case company therefore believes that if the online customer is exposed to the articles that are available in both the online warehouse and in the brick and mortar stores warehouse, the supply for the customer demand can be optimized. By optimizing the availability for the online store, the online store will get a better starting position when it comes to delivered quality experience, especially when the company is entering a new market online.

Since the orders are set approximately six months in advance, and can only be changed to some extent during the occurring season, the option with the most potential to increase the article availability in the online channel is to reallocate the articles from the brick and mortar store warehouse to the online warehouse.

4.2. Availability test: designing the framework

Following section describes how the framework was developed and how the thresholds were determined. The section describes the company specific conditions, i.e. predetermined conditions and the impact of these, available data that was implemented in the framework and the classifications of data. In addition the section describes the selected thresholds for identifying articles with reallocation potential and explains why these were chosen.

4.2.1. Purpose of the framework

The purpose of the framework was to first identify articles which could increase availability online. Secondly the framework had to ensure that the reallocations benefited both channels, i.e. to determine whether the identified articles had greater sales potential in the online store compared to the brick and mortar store. By reallocating the identified articles the test wished to achieve greater availability, which can be measured as decreased deletions and increased sales. By excluding the articles with high sales figures in the brick and mortar store, the reallocations was considered to not decrease the customer experience in the brick and mortar store and thus reallocated articles that risked price reductions in the future.

4.2.2. Predetermined conditions

Purchasing procedures

As mentioned in the description on the case company, the case company has limited flexibility in the order quantity. It is common to place additional orders when the stock levels reach a certain and predetermined level, but this is not applied in the case company. The timing of refills and quantity of each article refill is set in advance, and does not vary with the article sold, i.e. stock levels. However, the buying office can place additional orders and decrease a few orders quantity, but this flexibility is limited and does not apply during the test period.

Additional Store Share

It is important to take the share of the additional stock compared to the total brick and mortar stock into consideration. For example, the additional stock share was 42 percent smaller than the average additional stock share when studying comparable markets at the case company. If the additional stock share is low, the possibilities of reallocations to the online store is limited, since a large share of the articles are allocated in the brick and mortar stores and the reallocations solely were performed from the additional stock warehouse and not from the brick and mortar stores.

Share of Sales

The share of sales in the two channels should also be taken into consideration. In the methodology, Section 3.1.2., it is mentioned that the channel with the lowest share is considered to have the highest potential of warehouse integration, which is one of the reasons for reallocating articles from the brick and mortar warehouse to the online warehouse in subunit 1. Nevertheless, the share of sales might differ in other markets, and the reallocation direction might therefore change.

Pending weeks online

The case company offers articles, which will have a refill within four weeks in the online store. This means that if the article is currently out of stock, but will have a refill within four weeks, the article is available to purchase online but with a late delivery date.

4.2.3. Key performance indicators

Sales

Sales through online store are defined as demand - deletion. Demand refers to when the customer places an order and click buy on the online store. Deletions is when the customer has clicked buy and repent one to all of the articles in the shopping cart before the order has been picked in the online warehouse. Sales in the brick and mortar store refer to the purchases made in the store, where deletions do not apply.

PI

PI is a performance indicator that visualizes how fast the articles are selling in relation to the stock. A high PI value indicates that the inventory sells off fast. In the test market, the PI value is less volatile in the brick and mortar store than in the online store. The average PI for the brick and mortar stores in the specific market for the test is 10 percent, whereas the average PI value for the online store is 18-20 percent. However, if the PI is on a stable 20 percent, it indicates that the article does not sell off and therefore risk to take up storage place for a long period of time.

The reason why the PI value is lower in the brick and mortar stores is since the brick and mortar stores have a ground allocation of the inventory and in addition to this a additional store stock warehouse. Since the online store does not need the ground allocation of goods, i.e. the inventory is allocated to solely one warehouse, the total pieces in stock is lower, thus the PI value is higher.

4.2.4. Available data and classifications

Product hierarchy

The case company has three levels of describing an item, which they refer to as the product hierarchy. The optimal approach to increase availability online is to build the framework with the threshold values on the lowest level of the product hierarchy, the size level. If the framework only identifies demand needed on an article level, the requested articles from the store warehouse risk to solely include sizes that already exist in the online warehouse, and thus will not increase availability.

The only data available on size level was an indoor stock list in sizes in the online warehouse, which was updated every week. When the framework had identified the final articles needed from the store warehouse, the stock size list from the online warehouse was incorporated with the purpose to exclude existing sizes which had more pieces available in the indoor stock than the forecasted demand.

Departments

The case company has four concepts, which all include 1-5 divisions each. The framework was divided into divisions combined with data showing which garment group, such as trousers or dresses, the article belonged to. The garment group was included to give an accurate forecast, which is explained in Section 3.3.1.

Time period

The framework was based on weekly figures, for example number of pieces sold per week in the two channels. The weekly data was based on data from Sunday-Saturday previous week, which entails that the reallocations should take place as soon as possible in the current week, to enable a decision based on updated data.

4.2.5. Threshold values

The threshold values are the rules that the article must fulfil to be reallocated. In the end of this section the rules of the specific test are summarized. The framework identified the articles that risked to be out of stock within a forecasted demand in weeks and decided how many pieces of each article that should be reallocated from the brick and mortar warehouse to the online warehouse to cover the demand period, if the articles had low sales in relation to the stock in the brick and mortar store.

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Decision rule of the framework

Below are the identified variables and the criterions for deciding which articles to reallocate and the quantities to reallocate of each article, where $\alpha_i, i=1,\dots,9$, are pre-determined target values.

PI Online $> \alpha_1$

PI Store $< \alpha_2$

Reductions $< \alpha_3$

Demand in weeks $= \alpha_4$

Refill week - Current week $> \alpha_5$

ASW (Average sold pieces per week) = $\frac{\text{Total sold}}{\text{Nr of weeks sold}}$

Forecasted demand needed = Peak factor \times ASW

Minimum value $= \alpha_6$

Ending life cycle
= Number of pieces sold last week $< \alpha_7$
= Indoor stock $< \alpha_8$
= Number of weeks sold $> \alpha_9$

Notice that, this decision rule is general in the sense that it may be used in other similar settings (at different companies). Using this rule, the main challenge for a company is to set the target threshold values α_i and α_2 correctly.

PI

Due to the large amount of data, the PI was chosen to be the first threshold value to identify the articles with reallocation potential. Articles with high PI equals articles with high sales figures in relation to the indoor stock, i.e. articles with high PI risk to be out of stock if the articles demand persist, and there is a higher risk of low availability in specific sizes when the stock is low. The PI is calculated as shown below;

$$PI = \frac{\text{(Number of pieces sold Monday–Sunday previous week)}}{\text{(Indoor stock Sunday prev. week) + (Nr of pieces sold Monday–Sunday prev. week)}}$$

The first rule was therefore to only include articles with a PI Online over α_1 . In the test the PI Online value was decided to include the articles that had PI over 0.20. The articles under 0.2 PI Online were excluded, since the risk for the articles to be out of stock in the close future was considered low.

The PI Store value of the article in the brick and mortar store was included in a later stage of the framework. Articles which had PI Store over 0.1 was excluded to delimit the risk of reallocating articles with high sales potential in the brick and mortar store.

The threshold values for PI Online and PI Store were decided through interviews with merchandisers for the two channels and through elaborating with data from the previous year to see the effect of changing the threshold values.

Reductions

After including the articles with more than 0.2 PI Online in the framework, the next step was to exclude the articles with a high share of price reductions. The framework did not include articles on sale since these are articles the online merchandisers wanted to sell off fast by reducing the price. The framework therefore excluded all articles that had price reductions over α_3 . In this specific test α_3 was set to 0.25, i.e. price reductions over 25 percent.

However, the case company did not have the share of price reductions for each article available. The share of price reductions was therefore calculated by:

$$\text{Price reduction} = \frac{(\text{Gross sales in TSEK previous week}) - (\text{Net sales in TSEK previous week})}{\text{Gross sales in TSEK previous week}}$$

Demand period

The demand period to cover, α_4 , was set to maximum two weeks. Since articles in fashion retail have short life cycles, a longer demand period would entail a larger risk for over allocation an article, hence risk future price reduction.

Refill week

The next step of the framework included the expected refill week for each article. This threshold value excluded articles with an expected refill the next coming week or the week after next coming week. If an article would get a refill within two weeks it was excluded due to the risk of over allocating the article, i.e. α_5 equals 2.

Since late refills occurred, the framework also included previous week in the refill values. This entailed that if an article had an expected refill week the previous week, but the indoor stock was 0, and the number of pieces sold during the previous week was lower than the refill amount, the refill was assumed to be late and expected to occur during the current week. Hence, the article was excluded, to eliminate the risk of over reallocation.

If the refill week was planned more than two weeks after the current week, or if there would be no refill, the demand period to cover, α_4 , was set to two weeks.

Average sold per week (ASW)

The average number of articles sold per week was calculated to demonstrate how each article had sold in the past. For example, one article could have sold 50 percent more articles previous week than the weeks before due to a campaign. The average sold per week therefore gave a more accurate overview of an article's performance, which was of importance since the forecasted demand has its foundation in the historical demand. ASW was calculated by dividing the total sales in pieces for an article with the number of weeks it had been selling.

Peak factor

Since the ASW is based on historical data, the framework included a peak factor. The peak factor ensured that the ASW would be combined with the forecast of future sales figures. Hence, to cover increased demand at forecasted peaks, ASW was multiplied by a peak factor based on last year's sales and increased sales due to coming activities for the product season. A thorough description on how the peak factor was determined is presented in Section 3.1.1.

Forecasted demand needed

By multiplying ASW with the peak factor and the forecasted demand period to cover, the forecasted demand was calculated. The amount of articles in the indoor stock online was thereafter subtracted from the forecasted demand in number of pieces, to get the number of pieces needed from the additional store stock.

Minimum value

The minimum value of the total number of pieces per article multiplied by the price, α_6 , was set to 500 SEK. The minimum value was decided after elaborations with data from previous year, of a range of a minimum value between 500 to 1000 SEK. The minimum value of 500 SEK was chosen since 1000 SEK excluded between 18-27 percent of the total value of the reallocations for the smaller subdivisions, compared to 6-15 percent with 500 SEK. Since the purpose of the test was to increase the availability online, the 1000 SEK threshold was considered to exclude too many articles with availability potential.

Eliminating articles with ending life cycle

Since the forecasted demand for each article is based on the historical sales figures for each article, the framework included a final threshold to ensure that reallocations would not occur for articles which had a high PI due to low indoor stock in the beginning of the previous week. For example; if an article had sold 3 pieces and had one piece left in the indoor stock, the PI would be 0.75, $(3/(3+1))$. This could be a sign of a highly demanded article, but also an article which is in the end of the life cycle. To exclude articles, which were considered to be in the end of their life

cycles, a threshold was created to exclude articles from the reallocation list. An article was excluded from the reallocation list if all of the conditions were fulfilled:

- The article has sold less than three pieces previous week, α_7 equals three.
- The indoor stock has less than three pieces left of the article, α_8 equals three.
- The article has sold for more than 6 weeks, α_9 equals three.

Brick and mortar data

The articles that fulfilled all the conditions mentioned were considered to have a need of reallocation. To enable a reallocation the article had to be available in the brick and mortar indoor stock, i.e. the additional store stock. No articles in the additional store stock was reserved to the brick and mortar store, i.e. if the articles needed online was equal or less than the quantity in the additional store stock, all articles were moved to the online warehouse. If the article was available in the additional store stock and the article had a PI Store under 10 percent, the article was reallocated.

Sizes

The final step of the framework compared the available sizes in the online warehouse with the requested amount to reallocate. The sizes that were not available or had few pieces in the online stock were reallocated from the brick and mortar warehouse. The decision on whether the existing stock level on a certain size was sufficient was based on a suggested size range from the program from where the reallocation was ordered.

4.2.6. Summary of the reallocation rules

Below is a summary of the conditions an article must fulfil to be reallocated:

1. The article must have a PI value over 0.2
2. The article must have a PI in the brick and mortar store under 0.1
3. The article must have a share of price reductions under 25 percent
4. The forecasted demand has to be larger than the amount of pieces available in the online warehouse stock.
5. The article must not have a planned refill week or a planned refill week more than two weeks after the current week.
6. The total value for the pieces of the article planned to be reallocated must be 500 SEK or more.
7. The article must not be in the end of the lifecycle, i.e. the article must have sold less than three pieces previous week, the indoor stock online must have less than three pieces left of the article, and the article must have sold for more than 6 weeks.
8. The article must be available in the brick and mortar additional store stock.

If all these conditions were fulfilled the sizes available online for the identified articles were excluded if the stock level on a specific size matched the level of the suggested size range in the program where the reallocations were ordered.

4.3. Delimitations in the framework

PI

Since the first threshold value to identify needed articles is PI, the framework only includes articles with sales the previous week. The framework does not consider articles that have sold out or have not sold any articles last week, since these articles do not have a PI value. However, the risk for articles to be out of stock in the future decreases by the implementing the framework.

Weekly data

Due to the limitations in accessible data the framework was based on the figures from the previous week. This entails that the data the reallocation decisions are based on is not updated after Saturday the previous week. It would therefore be preferable to base the reallocation decisions on adjusted weekly data, based on a time period from the current day.

Size level

As mentioned before, the framework only includes size data in the end by excluding already existing sizes in the online warehouse. It would be preferable to only use data on size level, hence not base the framework on article level. If the framework included size level from the beginning, the framework would identify the sizes with high demand in the first step and be more accurate in the forecasted demand.

Returns

The framework does not include the return aspect, i.e. the share of the returns for the articles sold online. The share of returns online for the market the framework was performed in was considered to be low and would therefore have limited effect on the forecasted demand. The share of returns online in the market was on average 14 percent, however only 50 percent was returned within two weeks. This entailed that approximately 7 percent could be excluded. However, since the primary purpose of the framework was to increase availability, this factor was considered to have too little impact to include it in the test.

4.4. The logistical impact of the test

The decision on which articles to include in the reallocation was always made on Mondays, which resulted in lists that were sent to the brick and mortar warehouse, including the specific articles and quantities requested for each size. The warehouse

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thereafter processed the orders and returned lists of the definite quantities of each size of each article that were sent to the online warehouse. When the lists were received the definite quantities of each article's sizes were activated on the webpage and were visual for the customer within 24 hours. However, the customer who wanted to purchase these articles was given information of late delivery date, since the information systems of the case company processed the order as a refill within a four weeks period.

Depending on when the brick and mortar warehouse sent the articles to the online warehouse, the articles were available in the indoor stock at the online warehouse after the online warehouse had processed the orders. When the articles were in the indoor stock the delivery time to the customers decreased to the regular shipping time, instead of late delivery time. The average timing for each step was four days between the date the forecast was performed and the date where the articles were available in the online store. There were additionally six days on average between the date the articles were available on the online store and the articles were available in the indoor stock. On average it took 10 days from the forecast date and the indoor stock date. The cost for transport and handling in the warehouses was estimated to 9 SEK per piece.

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5. Result of implementing the framework

This section describes the result of the reallocation test in subunit 1 and whether the result supports proposition 1-3 or not. The section will thereafter present the results from the reallocations performed in subunit 2 and will therefore enabling verifying proposition 4.

5.1. Success rate of the framework

Since the framework determined the reallocations, which enabled the proposition 1, 2 and 3 to be investigated, the performance of the framework has also been analysed. This was done by comparing actual sales figures with the forecasted sales figures of the reallocated articles, which resulted in a ratio, which indicates to what extent the forecasted demand was reached. Ratio 1 equals that the forecasted sales equals the actual sales, since the ratio is based on actual sales divided by the forecasted sales.

Below the result is presented according to two different metrics and from three different starting dates: the date the forecast was performed (FCdate), the date the articles were available on the online store (Order) and the date the articles were in the online stock (Stock). The reason for measuring sales figures from different dates was to see if the success rate of the forecast would differ between the dates, and thus if any of the dates had higher impact on the sales figures than the others. The two metrics that were used for each week and each date were:

1. average ratio for all articles
2. average ratio for all articles when articles with a ratio over 1 is adjusted to 1

	Metric 1			Metric 2		
	Fcdate	Order	Stock	Fcdate	Order	Stock
W13	1.22	0.99	1.01	0.50	0.60	0.64
W14	1.24	0.76	0.81	0.76	0.60	0.62
W15	0.71	0.78	0.83	0.63	0.72	0.77
W16	1.01	0.95	0.94	0.84	0.84	0.83

Table 1. Sales/forecast

The ratios that are marked in red are the highest ratios for each week's metric. In week 13 the most accurate forecast was based from the indoor stock date, whereas week 14 has the most accurate forecast from the date the forecast was estimated. In week 15 the forecast from the date the forecast was performed was the most accurate whereas week 16's ratios from the three different forecast dates are similar

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to a larger extent than the other week's ratios. As seen in the table, the date that perform best differs between the different weeks, why it is not possible to draw any conclusion considering which forecast date that has the highest ratio over the time period.

The ratios indicate that the forecasts are more accurate over time. For example, metric 2 is approximately 0.84 week 16 compared to 0.58 in week 13. The different forecast ratios are also becoming less volatile over the four-week period. The average difference between the highest ratio and the lowest ratio is 0.22 for week 13, 0.2 for week 14, 0.14 for week 15 and 0.03 for week 16. This trend can be explained by the negative sales impact of the Easter holidays. The framework only increased the average sales per week by the peak factor, and thus never decreased the average sales per week. The effect of this is evident in week 13 and week 14 which have the lower ratios.

The metric that predominantly indicates whether the forecast performed well is metric 2 since it limits the effects of high ratios due to refills. The majority of the articles which had higher actual sales figures than the forecast, had a refill week within four weeks, which resulted in that the articles in the coming refill was available for sale on the online store. This indicates the importance of the full availability online since the refill entailed full size scales available on the online store, which led to higher sales figures.

The average ratio for the four weeks for metric 2 were; 0.58 for week 13, 0.66 for week 14, 0.71 for week 15 and 0.83 for week 16. As mentioned if the ratio would be 1, this indicates that the article would have sold out within two weeks, which is difficult to achieve since the reallocations decisions were not based on size data. This entails that the framework only took into consideration the sizes that existed in the online stock and adjusted the reallocation after this. However, this entails a risk that the reallocated sizes were not the one with the highest demand, and thus the articles did not sell as forecasted since the sizes available on the online store did not match the demanded sizes.

5.2. Answering the propositions

This section presents the result of the empirical work by answering the propositions that are presented in the literature review in Section 2.

5.2.1. Proposition 1

“The demand between the brick and mortar store and the online store differ in terms of that some articles have higher average demand in one channel compared to the other.”

By using the framework described in Section 4.2, the number of articles that were in need for reallocation was generated. The first row in table 2 represents the share of articles that had; higher PI than α_1 in the online store, higher PI in the online store than in the brick and mortar store, stock in the additional store warehouse. In average, the number of articles corresponded to 3.8 percent of the number of articles sold in the online store, that were also available in the brick and mortar store, during the timeframe of the reallocations.

During the reallocation a limit was however set at α_2 , in order to avoid reallocating articles that had high demand in the brick and mortar store during the test. This led to that the average number of articles that were actually reallocated corresponded to 1.1 percent of the sold articles during the timeframe of the reallocations.

Comparing the two rows in the table 2, it is a 70 percent decrease in how many articles that were reallocated compared to the ones that were identified using the framework.

	W13	W14	W15	W16	Total
Articles available in the additional store stock	3.8%	4.6%	2.5%	4.3%	3.8%
Moved articles	1.1%	1.1%	0.7%	1.5%	1.1%

Table 2. Difference in demand

In summary, this shows that 3.8 percent of the articles could have benefited from being sold in the online channel instead of the brick and mortar channel, since the articles are identified as having higher demand than the available stock accounts for during the demand period, but still is available in the brick and mortar additional store stock.

5.2.2. Proposition 2

"By reallocating articles, the sales in the online store will increase by the value of the reallocated articles within the given demand period."

"The reallocated articles will contribute to increasing the total sales across the channels, i.e. the reallocations will not decrease the sales in the brick and mortar store and will increase sales in the online store during the demand period."

By reallocating the articles based on the criteria of the framework presented in Section 4.2.5, the sales of the reallocated articles increased in average by 67 percent from the day the products were available online and 63 percent from the day they were available in stock. This can be seen in the table below.

	Available online	Available in stock
W13	39%	45%
W14	52%	58%
W15	99%	98%
W16	72%	57%
Total	67%	63%

Table 3. Increasing sales of reallocated articles

The increased sales corresponded to 40 or 36 percent of the reallocated value, depending of which timeframe the sales figures were measured from. This can be seen in table 4. This indicates how difficult it is to predict the demand, as well as it indicates the importance of timing since the products were available in the online store approximately four days after the articles were generated from the framework and thereafter available in stock approximately six days after they were available online. It is also important to consider that the values of 40 and 36 percent is can be underestimated, since sales in the scenario without reallocations are based on an assumption that all sold pieces would have been sold regardless of size.

	Available online	Available in stock
W13	18%	19%
W14	26%	27%
W15	56%	55%
W16	61%	47%
Total	40%	36%

Table 4. Increasing sales share of moved value

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The remaining part of the moved value were considered unnecessary in terms of not contributing to increasing peaks online, or unnecessary in terms of that it could potentially have been sold in the brick and mortar channel. It did not, however, compromise the sales in brick and mortar store to a large extent, since the articles that did not increase the sales in the online store and had potential in selling in the brick and mortar store only comprised 4-5 percent of the total sales lift. This is visualised in table 5. The negative effect of these reallocations is therefore negligible if comparing it to the sales volume in the brick and mortar channel. The value of 4-5 percent can also be overestimated, since it only indicates that there were no stock left in the additional store stock for the merchandisers to push to the brick and mortar stores, there could however be stock left in the brick and mortar stores, but this data was not accessible. Thus, since the overall performance increased, with only 4-5 percent of the articles not increasing the sales in the online store and not being available in the brick and mortar store additional store stock, the reallocations were considered to be beneficial from a multichannel perspective.

	Available online	Available in stock
W13	6%	8%
W14	4%	4%
W15	3%	5%
W16	3%	3%
Total	4%	5%

Table 5. Unsuccessful reallocated articles

The increased value corresponds to a sales lift of 0.2 percent of the total sales online. If applying these measures to a full potential in integrated multichannel warehouse, the sales would increase by 1.2 percent, since only 17 percent of the identified pieces with higher demand in the online store were actually reallocated due to the limit of PI 0.1 in the brick and mortar channel. Observe that this scaling differs from the scaling between additional store stock and reallocated articles in Section 5.2.1, where the scaling was based on how the limit of the brick and mortar PI affected the number of articles reallocated instead of in this section where it affects the number of reallocated pieces.

5.2.3 Proposition 3

“Reallocation of articles to the online warehouse will decrease the average share of deletions for companies in fashion retail.”

Deletions are an important measure since it can affect the customer satisfaction in terms of availability, as described in Section 2.3. As described in table 6, there was a decrease of 3 percent in deletions when the articles were available online. One

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exception when studying the reallocations was made week 16, where the levels of deletions were constant. If compared to the other reallocations, the reallocation week 16 had lower levels of deletions before the reallocation were performed, which could be one explanation of why it did not decrease the week the articles were available online. In total, the level of deletions was reduced by 44 percent.

	2 weeks before	1 week before	Available online
W13	5%	7%	2%
W14	7%	7%	5%
W15	7%	9%	3%
W16	5%	4%	4%
Tot	6%	7%	4%

Table 6. Deletion % when available online

When studying the outcome of the deletions in table 7, from a perspective of when the articles were available in stock, the deletions did not drop. One exception is week 15, when the deletions dropped three percentage points. However, this week also stood out in terms of how many days that was between the date the articles were visible online and when they arrived in stock. During the other weeks, it took approximately six days for the articles to arrive in stock from the day they were visible online, but in week 15, a major part of the articles were transported to the stock the same day. Since the two events coincided, it can be an explanation of why the deletions dropped that week.

	2 weeks before	1 week before	Available in stock
W13	7%	3%	3%
W14	5%	4%	4%
W15	10%	8%	5%
W16	4%	3%	4%
Tot	6%	5%	4%

Table 7. Deletion % when available online

When comparing the two different perspectives of availability, as in the day the customer was exposed to an increased size range of the article online, and the day the article was physically available in stock and thus leading to shorter delivery time, it occurs that the day the article had larger availability online had highest impact on the customers likeliness of not deleting an article.

5.2.4. Proposition 4

“Reallocation of articles to the channel with highest demand in relation to the allocated stock will contribute to reducing price reductions.”

The reallocations performed in subunit 2, were performed last season with the purpose of reducing price reductions. The reallocations were conducted over a period of six weeks, with one reallocation every week.

The rules for reallocating articles were based on:

- PI: articles with PI over α_{10} in store and lower than α_{11} online
- Stock levels
- Price reductions
- Average sold per week

The only measure stated above that was fixed in determining which articles to reallocate, was the levels of PI. The other parameters rather functioned as measures that could be taken into consideration during the decision-making.

The table below presents a summary of the outcome of the reallocations in terms of decreasing need for price reduction. It describes that the combined price reductions online and in brick and mortar decreased by 19 percent on the reallocated articles. The figures were calculated according to the procedure described in Section 3.3.4.

	Decreased reduction & discount	Unsuccessful reallocations	Value of unsuccessful reallocation
W30	24%	6%	-0.4%
W31	20%	27%	-0.3%
W32	13%	13%	-4.0%
W33	20%	27%	-0.3%
W34	15%	12%	-0.5%
W35	21%	20%	-0.8%
Tot	19%	18%	-0.9%

Table 8. Result from the reallocations

When reviewing the outcome of the reallocations, it is evident that the overall performance is positive. However 18 percent of the reallocated articles are regarded as unsuccessful reallocations, although the reallocations solely decreased the sales outcome of the reallocations by 0.9 percent.

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The unsuccessful reallocations have been divided into three types as seen in the table below. Unsuccessful moves due to no price reductions, unsuccessful moves due to good online performance, and unsuccessful moves due to high price reductions in store. The values in the table describe how much of the articles' value that were lost in the reallocation. For example; in week 30 no articles lost sales due to no price reductions or good online performance, but articles that originally were sold to 100 SEK lost 5 SEK due to price reductions in the brick and mortar store.

	No price reductions	Good online performance	High price reductions in store
W30	0%	0%	-5%
W31	-2%	-3%	-12%
W32	0%	0%	-42%
W33	-3%	0%	-1%
W34	-3%	0%	-11%
W35	-2%	-1%	-9%
Tot	-2%	-2%	-14%

Table 9. Types of unsuccessful reallocations

The unsuccessful moves due to high price reductions in the brick and mortar store stand for the highest value of lost sales. One feature these unsuccessful reallocations have in common is that the moved quantity of pieces is large in relation to the stock in brick and mortar warehouse. The average ratio between the reallocation quantity and stock in brick and mortar was 0.48 when the move was regarded as unsuccessful. Following the same argument, the average ratio was 0.24 when regarded as successful.

The reason for this is if the quantity of the reallocated pieces is large in relation to the stock in brick and mortar, the reallocation will affect the stock levels to a larger extent, and thus, the difference in price reductions between moving and not moving will be larger. This can be compared to a scenario where the quantity of moved pieces is small in relation to the stock. When moving pieces to the brick and mortar store in this scenario, the stock levels will not be substantially affected.

There are examples of reallocated articles with a higher ratio than 0.24 that has been considered successful. These articles have, however, been performing poor in terms of high share of price reductions in the online channel after the moves have been performed, and could therefore have been reduced even more if not moved. Thus, when reallocating articles with the purpose of decreasing price reductions, the importance of accurate forecasting is higher when considering to reallocating

articles that will affect the stock levels to a larger extent. Therefore, when reviewing the four measures described above for reallocating articles, stock levels is the measure that should be used as a guideline on when more thoroughly forecasting is needed on the reallocations. With the findings above, the recommendation is to be more considerate when handling articles with a higher reallocation/stock ratio than 0.24.

As seen in table 8, the outcomes of the reallocations were positive, with increasing the reallocated articles sales of 19 percent due to decreased price reductions. Even though the unsuccessful reallocations only decreased the total outcome by 1 percent, these could have been avoided by implementing an integrated multichannel warehouse. In addition, by implementing an integrated warehouse the price reductions would probably also decrease on additional articles that fall out of the reallocation criteria described above.

Lastly, to put the effect of the reallocations in relation to the overall performance of last season, the average total price reductions were compared to the average total price reductions in a scenario without reallocations. The total price reductions of the season were 22.2 percent, compared to a scenario without reallocations were the price reductions would have been 22.6 percent. It may not appear much, however the decrease in price reductions has an effect on every sold piece.

To visualize this, the following example is presented:

Price: 100 SEK

Sold pieces: 1 000 000 pcs

Decreased reduction: 400 000 SEK

5.3. Applying the result outside the case

This section aims to discuss how the results can be applied outside the case. The factors that could have affected the result of the reallocations in Section 5.2 is the additional store stock share, the multichannel share, pending, PI limit of α_2 in the brick and mortar channel, and share of comparable assortment.

5.3.1. Additional store stock share

The additional store share of the brick and mortar is of high importance when investigating the multichannel potential. The reallocations performed in subunit 1 had a low additional store share, compared to the average share at the case company. If applying the finding on other markets in the case company, as well as other companies in the fashion industry, this is an important factor to consider when estimating the potential, since a larger additional store share implicates a larger

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multichannel potential. This implies that the overall potential at the case company could be 2.1 percent, as stated in the calculations below.

Increasing sales online according to Section 5.2.2=1.2 percent

Additional store share, subunit 1=42 % less than the average store share in the case company

$$1.2/(1 - 0.42) = 2.1 \text{ percent}$$

5.3.2. Multichannel share

The multichannel share implies which channel that benefits most from integrating multichannels by reallocating articles. In the case company the online share of the business is significantly smaller than the brick and mortar share of business, both in subunit 1 and subunit 2. The larger the online share is, the more the brick and mortar channel can benefit from multichannels. However, from a multichannel perspective, the benefit is the same, just distributed differently between the channels.

5.3.3. Pending

In the case company, subunit 1 is the only market that sells articles on pending in the online channel. Therefore the analysis included and compared both the day the articles were available online, and the day they were available in stock. As seen in Section 5.2.2, the difference in increased value did not differ much between the different perspectives of time, and pending are thus considered to have low impact on the benefits of multichannels.

5.3.4. Brick and mortar store's PI limit

One limit that was considered during the reallocation test was the brick and mortar limit of only sending articles with a PI lower than α_2 . This PI limit in that a high share of the requested articles online was not reallocated even if the PI was substantially higher than in brick and mortar store. The limit was set in order to not compromise the business in the brick and mortar channel during the reallocation test. It can however be argued that the idea of multichannels integration is that the article should be sold in the channel where it is requested first, and that entails that if an key items is requested first in the online store, it is also there it should be sold. For future reallocations, it would therefore be better to not set a PI limit, but instead estimate if the brick and mortar warehouse would have sufficient stock to handle the demand period of two weeks.

By scaling the increased sales from the reallocation test with the potential articles from brick and mortar additional store stock, an attempt was made to achieve the
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total potential benefit in multichannel warehouses, which lead to a value of increased sales online with 1.2 percent. When doing this it is important to consider that only 40 percent of the moved value contributed to increased peaks online, and that it is this value that has been scaled in the attempt of estimating the potential of multichannels. A valid question is therefore if the share of 40 percent would be higher if no limit of PI would have existed from the brick and mortar channel, and thus if the benefit of multichannels would be higher than a 1.2 percent increase in sales online.

5.3.5. Share of comparable articles

In the case company, only 50 percent of the articles are comparable in the online channel and the brick and mortar channel, which implies that the multichannel perspective only benefit half of the business. If applying this to other companies in fashion retail with a larger share of matching articles, even identical supply of articles, the multichannel potential stated in Section 5.2.2 could increase up to 100 percent.

5.4. Conclusion

The following section provides a summary of the findings, based on the result from the empirical study in Section 5.1 with the attempt to look beyond the implications of the subunits and the case in 5.2.

5.4.1. Proposition 1

The case study implies that 4 percent of the comparable articles have; high sales online in relation to the stock, low sales in the brick and mortar channel in relation to the stock, stock available in the additional store warehouse. 4 percent of the articles can therefore benefit from being reallocated and be sold in a different channel.

5.4.2. Proposition 2

By reallocating articles to the online warehouse, the sales on the reallocated articles increased on average by 67 percent.

The reallocation contributed to a sales lift of 0.2 percent of the total sales online. By relating that to a future potential in integrating multichannel warehouses without any brick and mortar limits on PI other than the warehouse must have enough stock in the additional store stock to cover the demand period, the sales online could increase by 1.2 percent.

The increased sales in the online channel corresponded to 40 percent of the reallocated value. The remaining part of the reallocated value were considered unnecessary in terms of not contributing to increasing peaks online under the demand period, or unnecessary in terms of that it could potentially have been sold in the brick and mortar channel. The reallocations did not compromise the sales in brick and mortar store to a large extent, since the articles that would have benefited more from being sold in the brick and mortar channel only comprised 4-5 percent of the total sales lift.

The factors that could potentially have had an effect on the result of the reallocations, and therefore must be adjusted for in other situations, were the additional store stock share, the multichannel share, pending, the PI limit of α_2 in the brick and mortar channel, and share of comparable assortment.

The additional store stock share and the share of comparable articles have high impact of the reallocation potential. A larger additional store stock share implicates a larger multichannel potential. The small additional store stock share accounted for approximately 50 percent of the average additional store stock share in the case company. In the case company, only 50 percent of the articles are comparable in the online channel and the brick and mortar channel, which implies that the multichannel perspective only benefit half of the business. If applying this to other companies with a larger share of matching articles, even identical supply of articles, the multichannel potential could increase significantly.

5.4.3. Proposition 3

The deletions on the reallocated articles decreased by 44 percent by the time the reallocated articles were available online. The deletions did not drop when the reallocated articles were available in stock, i.e. shorter delivery time. It implies that availability, in terms of full size range has a larger effect on the customers' likeliness of not terminating an order, than the delivery time.

5.4.4. Proposition 4

The reallocation contributed to decreasing price reductions of 19 percent of the reallocated articles. To put that in relation to the overall performance last season, the total price reductions of the season were 22.2 percent, compared to a scenario without reallocations were the price reductions could have been 22.6 percent.

The unsuccessful reallocations were mainly due to larger price reductions than expected in store, and lower price reductions in the online channel than expected. This could have been avoided by being more considerate when handling articles with a higher reallocation/stock ratio than 0.24.

6. Discussion

In the following section the implications of the reallocation test are discussed in perspective of the literature presented in Section 2. When fulfilling the purpose of the thesis by implementing the reallocation test insights were gained in the challenges in implementing multichannel integration. These insights can be applied in other multichannel environments, such as challenges in the data integration, the importance of timing when reallocating articles between the channels and the impact on key performance indicators in the multichannel environment in terms of creating adaptability, agility and alignment and are thus discussed below.

6.1. Challenges in data integration

As mentioned in the Literature review 2.1.2. multichannel integration can relate to data integration. However, one of the obstacles in implementing the reallocations between the multichannels was the data integration. Even though the two channels performance were measured by similar or equal performance indications, the data was often hard to integrate since the data was presented in different manners, which increased the risk of not interpreting the data correct and led to manual steps in the data integration. For example most of the data needed in the framework was assessable in the two channels sales report that was conducted every week. However, one of the reports could not be used since it was not possible to extract the data manually from the report, which led to several data withdrawals from different databases instead of one. Due to this it is of importance to have a multichannel perspective in mind when reports and information systems are developed, i.e. to be able to merge the available information.

Another challenge in reaching full potential of multichannel integration was the lack of data on a size level. The only available data on size level was the indoor stock in the online warehouse, which was included in the framework in the final step. However, the current indoor stock did not reveal data that corresponds to the demand, i.e. the actual sales figures. An article might never appear in the framework since the PI Online is under the threshold value, however this article might only have a few sizes left, but in high quantities with low demand. If the data in the framework was based on size data the sizes that had high sales figures in comparison with the available stock would have been identified and the quantities in sizes could be based on actual sales figures, rather than solely what is currently in the stock. In addition, the lack of data on size level may have contributed to an underestimation of the sales increase in proposition 2. Since the effect on the reallocated articles only could be measured at article level, the assumption that in the scenario of no reallocations, all pieces in the stock would have been sold out if the actual sales exceeded the stock level before the reallocations, was made. Therefore, if increasing availability is

the aim, size level data is of great importance. However, the impact size level data could have in a similar multichannel integration is hard to evaluate without the accessible data.

If size level data was accessible, the size curve, which determine how much of each size that should be purchased, could be investigated and optimized. When the case company's buying office is placing an order the standardized size curve is set in advance. However, an article can only sell what is available, which means that the size curve risk not to be adjusted after the actual demand. For example, if only 100 pieces of size XS is purchased and sold, the size curve can be interpreted as if the size curve corresponds with the demand. However, the demand can be higher than 100 pieces, but the potential will never be investigated since there are no performance indicators on size level. If having PI Online on size level the merchandisers could get current data on which sizes that should be refilled and the size curve could be better adjusted to the specific demand in the two channels.

By making the data available and comparable between the channels, which had to be made to perform the reallocation test, the company is one step closer to the integration of the external information, such as customers' information access. An example of the potential in what data integration in customer access can enable is information access in inventory databases, such as enabling the Website to allow customers to search for articles available in the brick and mortar store or by offering the customer real-time information on inventory online, to decrease the risk for visiting a store to purchase a specific article when the article is not in stock.

In the literature review it is mentioned that data integration enables the firm to get more data on the customer behaviour and allocate the resources across the channels, which will strengthen the final offer to the customer. An example of how the data integration in the reallocation test has contributed to increased customer data behaviour is the insights of the effect on deletion when increasing availability. By increasing the availabilities the share of deletions decreased. The deletions data is only accessible in the online store, however the finding can help brick and mortar stores to improve their offer since it argues for the importance of offering a range of sizes.

By answering proposition 2a, see Section 2.4, this thesis also contributed to the existing literature in the effects of multichannel integration. In addition the effects of the increased availability caused by the reallocation of articles showed that multichannel integration could have a positive effect on the share of deletions. The positive effect on the decreased share of deletions thus contributes to the literature within availability, since the reallocation test shows the impact of availability in terms of decreasing deletions. The deletion effect can further be a measure of

customer satisfaction, since a high share of deletions risk to cause low customer satisfaction when it is due to late delivery dates or missing sizes or colours of specific products.

In Section 2.3.1. the literature review puts forward the importance of minimizing the number of late orders and tracking order and unit fill rates, as well as taking action on when orders are expected to be late, to minimize the late delivery. However, to be able to take action upon decreasing late deliveries the data of refill and delivery to the customer must be reliable. In the test the customer was informed that the reallocated articles would be delivered within 4 weeks, due to the pending system. The pending system increase the difficulties of tracking refill and orders since the online store offers the customer articles that are not available in the online store. The stock refill can be scheduled in four weeks, however the specific refill day is difficult to set far in advance due to the complexity of a supply chain that involves several actors and long distances. To offer articles on pending can therefore risk lowering the customer satisfaction when the articles are not delivered in time to a higher degree than the possible benefits of increasing the availability with articles that will be refilled.

6.2. The importance of timing

This thesis investigated the potential of increasing the availability by reallocating articles between the brick and mortar store warehouse and the online store warehouse. The key finding in the thesis is the importance of timing when it comes to increasing sales compared to decreasing price reductions. The short life cycles of an article increase the risk of reallocating articles in fashion retail with the purpose to increase the sales peaks. The likelihood of an article that have had high sales figures in the past to continue to have high sales figures in the future is therefore considered lower than the likelihood of an article with low sales figures in the past to continue to have low sales figures in the future.

The in depth study of the subunits in the case company made it possible to investigate effects and aspects of multichannel integration that have not yet been discussed in the literature. One major insight is thus the entailment of the differences in demand between the different channels as well as the difficulties in predicting demand in fashion retail, which was discovered when the reallocations based on the framework were analysed.

Due to the difficulty in identifying articles with high sales potential in the future the potential in reallocating articles between channels with this purpose is therefore considered to be high risk, especially since it is characterized by a push effect when reallocating articles based on forecasted demand. If the aim is to increase the sales

by offering higher availability, without purchasing larger quantities or increasing the flexibility in quantities and timing, the potential in visualizing the full stock in the brick and mortar additional share and the online warehouse on the online store should be investigated. By doing this the reallocation between the warehouses is performed after the order has been placed in the online store or the purchase of the article has been conducted in the brick and mortar store, i.e. there will be a refill of the sold article the next day to the brick and mortar store. This enables a pull effect, where the demand decides where the articles should be reallocated and thus limits the risk of reallocating articles with decreasing demand. However the quantities will be adjusted after daily figures and the reallocations must be performed on a daily basis to enable the reallocation to correlate with the demand. Another possible solution is to have completely integrated warehouses, but the difference in the warehouse distribution described in Section 2.5.1. can lead to high investment cost to be able to investigate the potential in this solution.

6.3. Agility, Adaptability and Alignment

In Section 2.5.2. the best value chain management is described by the importance of agility, adaptability and alignment in a multichannel environment (Lee, 2004). Agility refers to the ability to rapidly respond to changes in supply and demand, whereas adaptability is the capacity to reshape the supply chain and alignment represents the consistency in the interests of all actors in a supply chain. As described above the potential in increasing the agility by reallocating articles between the channels in terms of responding to high demand is considered lower than the potential in responding to low demand, i.e. to decrease share of price reductions. The potential in increasing the agility in high demand is low due to the timeframe. The logistical solution to reallocate one article from one warehouse to the other took on average more than a week in the reallocation test, despite the geographical distance of only a few hours between the warehouses. The conclusion to be drawn can therefore be that the possibility to increase the agility by reallocations was limited due to the low agility in the logistical solution of the distribution.

The limited agility in the distribution centres can in turn be a consequence of the lack of alignment between the channels in terms of key performance indicators. Since the reallocation test was not a part of the daily activities performed in the distribution centres the handling of the articles between the channels had a negative effect on the key performance indicators. The reallocations were therefore not prioritized since the handling procedures were not included in the system that measured the daily performance.

The challenges in implementing multichannel integration due to key performance indicators were also found in the merchandising teams in both the brick and mortar

store and the online store. The merchandisers are responsible for a specific division, such as ladies clothing, and are striving to improve the sales figures for their specific concept. In the case company the merchandising teams are separated between the online and brick and mortar store, which resulted in a protective attitude from both the brick and mortar and online stores merchandising teams.

The brick and mortar stores merchandising team was reluctant in reallocating articles since they saw a risk in losing potential sales, which resulted in a discussion of the PI Store limit, which was the threshold value that decided if an article was allowed to be reallocated from the brick and mortar store warehouse. In addition, the merchandising team in the online store identified a risk in reallocating articles with low sales potential which could lead to future price reductions and lowering their performance indicators regarding share of articles sold to full price. The individual performance indicators for the two channels therefore risk reducing the alignment in multichannel integration. To increase alignment in projects that involve the two channels or when a firm aims to increase the multichannel integration, the performance indicators that the employees are evaluated by must give incentives for integration or cooperation, and thus evaluate the total performance of the firm rather than the individual channels performance. By giving incentives to multichannel integration, and thus increase the alignment between the two channels, the adaptation towards multichannel integration can increase.

In addition to creating incentives for multichannel integration, tests as the one performed in this thesis, are of value to increase the knowledge of the implications of multichannel integration. By estimating the potential of increasing article availability or by reducing the share of price reductions, the alignment between the actors who are affected when integrating the channels can increase, which in turn can enhance the adaptability and agility.

6.4. Future research

As mentioned in Section 6.2, the potential in increasing the sales of reallocations involves high risk due to the short product life cycles of articles in fashion retail. To further investigate the potential in the multichannel integration within warehouse integration the next step could be to implement a test that visualize the combined stock in the brick and mortar additional store stock on the online store. By reallocating after an order has been placed in the online store or after the purchase of the article has been conducted in the brick and mortar store, the reallocations would be characterized by a pull effect rather than a push effect and therefore entail more accurate reallocations.

Optimization of sales in fashion retail by warehouse integration in multichannels

Another field to investigate to gain further insight in the implications of multichannel integration is how to create incentives for multichannel integration. By introducing key performance indicators that are developed to give incitement for multichannel integration the adaptability to reach customers' expectations of multichannel offers can increase.

To further investigate the potential of increasing availability online the effect on the cart abandonment should be taken into consideration. The case company solely had data regarding cart abandonment on a total level, i.e. the total share of cart abandonment of the total amount of visitors on the online store on a weekly basis. If it is possible to get more detailed data regarding cart abandonments or if it is possible to perform a availability test that involve large reallocation quantities that can give reliable data on the total cart abandonment, the impact of increasing warehouse integration in multichannel environment would gain further understanding.

A challenging research topic would be to consider re-allocation policies between more than two inventory locations. Consider, for example, the scenario of reallocating goods between several online store warehouses and brick and mortar warehouses.

While investigating the potential of reducing the share of price reductions by reallocations between the channels a question regarding the risks of reducing share of price reductions appeared. If the customers have come to expect price reductions during sales periods, the decrease of price reductions risks lowering the customer satisfaction. It is therefore of interest to investigate the benefits of reducing price reductions in relation to the risk of reducing the customer satisfaction when reducing price reduction, and thus the future sales.

Lastly, in order to generalize further on the implications of multichannels in fashion retail, case studies at other companies should be performed. It can validate the effects of this study, but also contribute to an understanding of how different conditions and prerequisites effect the implications of multichannels.

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Appendix I - Definitions

In order for the reader to get a better understanding of the thesis and the terminology, definitions that relate to the purpose of the thesis are hereby introduced.

Article: An article is the second highest level in the product hierarchy, and refers to the different colours and patterns the product offers, for example a blue dress.

Brick and mortar store: Physical store

Multichannel: A model in which retailers use a combination of two or more channels to sell products and services to customers. In this case study the definition of multichannel is limited to brick and mortar stores and an online store. (Schneider and Klabjan, 2012)

Additional store stock: The brick and mortar stores get a basic allocation of the articles, which entails that all articles that have been sent to the brick and mortar stores from the warehouse are registered in the stock. The brick and mortar store warehouse has additional inventory in the warehouse, which is called the additional store stock. When a product is sold in the brick and store, this is registered and the same product (colour and size) is sent from the additional store stock to the brick and mortar store for refill. The total stock for the brick and mortar stores is thereby defined as the additional store stock and the ground allocation in the brick and mortar store combined.

Cart abandonment: When customers put items in their online shopping carts online, but leave the webpage before completing the purchase.

Conversion rate: Conversion rate is the share of visitors that conduct a purchase in relation to the total number of visitors, used as a KPI in both brick and mortar stores and online stores.

Customer loyalty: A behaviour from a customer which is characterized by repeated purchasing, a positive attitude, intention to continue the relationship, expressing positive word-of-mouth and likelihood of not switching retailer (Davis-Sramek, 2007; Giese et al., 2004).

Deletion: Deletions refers to the event when the customer has completed the purchase shopping cart online, but regrets, i.e. deletes, one to all of the items in the basket before the order has been delivered.

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Demdel: The most frequently used sales key performance indicator in the online store. Demdel is the abbreviation of demand-deletions and describes the sales after the customer has deleted any items in the basket before the order has been delivered.

Discount: Target a larger group of products and take the form of offers, for example “buy one, get one free”.

Division: A grouping of products into different target groups, such as kids clothing.

Garment group: A grouping of products into different kinds of products, such as knitwear.

Gross sales: Sales before reduction and discount

Key items: Articles that initially bring customers in the brick and mortar store or articles that enable that the customer start a shopping cart in the online store, and thus increase the total sales with the additional items in the shopping basket in the two channels.

Net sales: Sales after reduction and discount

Pending: Refers to the possibility to buy products online even if the products have not arrived in stock yet.

PI: PI is a performance indicator that visualizes how fast the articles are selling in relation to the warehouse inventory. A high PI value indicates that the inventory sells off fast.

Product: A product is the highest level in the product hierarchy and refers to a garment with the same design, regardless of if it comes in different colours and patterns. For example a product is a dress, which is divided into several articles (colours) and sizes.

Product hierarchy: The product hierarchy refers to the different levels of describing a garment, which are product, article and size.

Reduction: A price reduction on a specific article, such as a dress sold to 75 percent of the original price.

Size: Sizes is the third and lowest level in the product hierarchy, and refers to the different sizes an article has.